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HANOR A. WEBB, *Editor*

Department of Science Education
George Peabody College for Teachers
Nashville, Tennessee

Contents

		PAGE
THE NATIONAL COMMITTEE ON SCIENCE TEACHING	*Ira C. Davis*	260
SOME FEATURES OF THE BACKGROUND	*Otis W. Caldwell*	264
THE SUB-COMMITTEE ON PHILOSOPHY	*Nathan A. Neal*	267
THE SUB-COMMITTEE ON NEEDS	*W. C. Croxton*	275
THE SUB-COMMITTEE ON EFFECTIVE PROCEDURES	*Robert L. Ebel*	278
THE SUB-COMMITTEE ON EVALUATION	*Carleton E. Preston*	283
THE SUB-COMMITTEE ON EFFECTIVE MATERIALS	*Emil L. Massey*	287
WHAT OF SUPERVISION?	*W. R. Teeters*	291
SCIENTIFIC GADGETS COME TO THE AID OF LEARNING	*Harry A. Carpenter*	296
DON'T FORGET SCIENCE IN THE GRADES!	*Jack Hudspeth*	301
IMPENDING CHANGES IN THE SCIENCE CURRICULUM	*Hanor A. Webb*	305
THE SPEECH CENTERED SCHOOL	*Edson C. Bates*	309
EDITORIALS		314
BOOK REVIEWS		315

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A COMMITTEE AT WORK

SIGNIFICANT current activities in the field of science education are the conferences of the National Committee on Science Teaching. All contributors of articles concerning science in this issue of EDUCATION are members of the Committee. Their articles, however, are in no sense "official"; a Committee Report, in several Parts, is scheduled for early publication.[1] Many of the philosophies expressed in the pages that follow may appear in the final Report in modified or expanded form, or they may not appear at all.

The authors of these articles were requested to write *as individuals*. They were asked to recall points that had been raised in the discussions of their own Sub-committees, or the General Committee, in which they took peculiar interest. The Chairman of the Committee itself, and the Chairmen of certain Sub-committees, were requested to tell of the steps by which their own groups "found their bearings" in the early meetings, and how their thinking changed as they progressed.

Two persons stand out in the recollections of this editor for their services during the difficulties of organization and starting the work. The Chairman of the National Science Committee, Dr. Ira C. Davis, had planned so thoroughly in thought and deed that no time was wasted, and constructive thinking was under way within an hour. As the Sub-committees debated, the dean of science educators, Dr. Otis W. Caldwell, visited each as a listener, but on invitation gave suggestions so clear and appropriate that some of the early mists of indefiniteness evaporated, and committee members began to talk to the point.

Committee work is not easy. Differing viewpoints must be reconciled between even the most reasonable members. Every idea must run the gauntlet, every expression prove its clarity—at times every word establish its right to be there. Committee reports, therefore, are hard-won composites of the wisdom of many; being composites they may lack personality and style. For the virtues of such reports everybody — and nobody—receives credit; for their faults everybody — and nobody — is to blame.

The articles that follow reveal the personalities of their authors, even when they record what was said and done in committee meetings. They represent reporters' viewpoints, written from notes and copies of tentative manuscripts. These articles constitute timely comment for present readers, and historical documents for future students of science education. For both present and future they furnish glimpses of the earnest labor of the National Science Committee which the final reports will conceal. —H. A. W

[1] For information as to these Reports in print, in press, and in preparation, write the Chairman, Dr. Ira C. Davis, School of Education, University of Wisconsin, Madison, Wis.

"I am more firmly convinced now than ever that all curricular programs should be initiated with classroom teachers." — DAVIS.

A genius for organization and securing coöperation has been demonstrated by Dr. Davis, of the School of Education, University of Wisconsin, Madison. It was first shown locally, then as President of the Department of Science Instruction, National Education Association, and now as leader of

The National Committee on Science Teaching

By IRA C. DAVIS

IT is not always easy to explain the origin of things. Neither is it easy to describe how a committee really begins to function. I recall that in most of the conventions I have attended the last ten years, some person, or group of persons, has made some kind of plea for a representative national committee of science teachers. The general thought seemed to be that all organizations working together could do much more effective work than they could by continuing to function as independent units. All of these discussions or comments ended with the same question: *How can we get these organizations to coöperate?*

The greatest impetus to the organization of the National Committee came from the Educational Policies Commission itself and from the reports it issued. A new type of educational program was in the making. What could science education do to promote this new program?

What does science education have to offer to provide boys and girls a good general education? Will its methods and attitudes help to give pupils a better understanding of how democracy functions in our everyday living? These are challenging questions. Many science teachers are eager to make plans for a science program which will meet this challenge.

The Department of Science Instruction of the National Education Association initiated the movement four years ago. The writer was invited to organize a national committee and to solicit funds from the National Education Association to help defray committee expenses. The request for funds was approved and a fund was promised each year for two years. Another two-year extension of funds has been voted and the National Education Association thus has given liberal financial support to the Committee.

All national organizations of science teachers were invited to coöperate in organizing the National Committee and to select one or two representatives to become members of the general committee. As a result all national organizations of science teachers agreed to coöperate, and elected at least one member for the National Committee. One national organization has sent representatives to attend committee meetings but has not formally elected a representative to the general committee.

The first meeting of the Committee was held in Cleveland in February, 1939. A general invitation was ex-

tended to many local, district, and state organizations to send representatives to the meeting. As a result, thirty-five persons attended as members of the general committee or as consultants. Had any committee ever proceeded on a democratic basis to form a science program? Would science teachers be willing to proceed on such a basis, and, if so, how?

The writer invited each member of the general committee to come to the first meeting with suggestions and plans for committee action. At the first meeting, each member presented his or her plans. Each plan was discussed by all persons present. Consultants and visitors were invited to take part.

It is always interesting to observe how people react when suggestions are made which differ from their firmly formed convictions. Some hasten to defend the status quo, others hasten to defend their own interests. Some will oppose change because it is change. Some believe subject matter itself must not be questioned, and others are willing to face facts and make changes when they are convinced changes are necessary.

Specialists in the fields of health, conservation, geography, guidance, and social studies were invited to attend the first meeting and to present possibilities in those areas for science education.

After nearly three days of worthwhile discussion, it was agreed that the efforts of the National Committee could be "speeded up" by dividing the Committee into six sub-committees, as follows: (1) Philosophy, or frame of reference; (2) desirable functional outcomes, or needs; (3) teacher education; (4) materials; (5) evaluation; (6) administration. Chairmen were selected for the sub-committees, and a general program of action planned in preparation for the following meeting in Cleveland in May, 1939.

A sincere effort was made after the first meeting to enlist the aid of all organizations in developing a new science program. Nearly 300 consultants and members are now coöperating. They come from all parts of the United States and from all types of schools. In some cities all of the science teachers coöperated. The chairman of the sub-committee on Needs states that more than 3,000 classroom teachers assisted in the investigation of the needs of boys and girls. The Teacher Education sub-committee sent a questionnaire and opinionnaire to more than 9,000 teachers. The number of returns exceeded all reasonable expectations. The Research Division of the N. E. A. coöperated in planning the questionnaire and opinionnaire, distributing the materials and making all necessary statistical calculations. The data obtained in this way has helped the Committee in the formulation of many plans and policies.

Full meetings of the Committee followed the Cleveland meeting in May at Chicago, St. Louis, Atlantic City, and again at Chicago. Other meetings were held at New York, San Francisco, and Milwaukee in coöperation with the summer meetings of the N. E. A. The progress of the Committee was reported at these summer meetings with discussions following each meeting. The attendance at the meetings varied from 60 to 100. On two occasions a check showed that the persons present at the meeting were in direct

contact, as administrators, supervisors, or heads of departments, with more than 11,000 science teachers.

The general procedure at each meeting was to have the group meet together for general discussion, to hear reports of the chairmen of sub-committees, and to discuss these reports. Each general meeting was followed by sub-committee meetings with much smaller groups. These in turn were followed by more general meetings. In this way it was possible to have all sub-committees work toward the same goal and to prevent too much overlapping or duplication of effort. Another sub-committee on "Effective Teaching Procedures" was added at the St. Louis meeting.

At each meeting it became necessary to explain to those in attendance for the first time the progress which had been made to date. This procedure delayed action in some respects but in others it helped to clarify the thinking of the Committee.

Real progress was made at each meeting. Free and frank discussion helped to clarify issues. Many differences of opinion disappeared when members understood each other. Since all were interested in improving and expanding the program in science teaching, the only place for difference of opinion could be in method or in the scope of the program. All agreed that the emphasis should be placed on the acquisition of desirable functional outcomes and not on any specific method for teaching for these outcomes. Since it is not known what subject matter is best to use to teach any of these outcomes, the Committee feels it should not approve any established body of subject matter. That does not mean in the least that subject matter will not be used. Certainly, no one would be bold enough to say that the present courses of study are so good they cannot be improved. Probably some subject matter not now taught would be more effective in teaching desirable outcomes. A gradual growth in thinking from teaching subject matter for the sake of subject matter to teaching science to acquire desirable functional outcomes has been apparent as the work of the Committee progressed from meeting to meeting.

Growing realization that science must help to solve the social problems which it has been instrumental in creating has changed the viewpoint of many members of the Committee. This brings teachers face to face with many controversial issues. Shall science teachers face these issues realistically or dodge them entirely? According to the results obtained by the questionnaire, science teachers state they are doing very little with these issues. They also state pupils would acquire more desirable outcomes from a study of these controversial issues than they are now getting from the study of our present body of subject matter.

The most interesting thing to me in all of the deliberations and discussions of the Committee was the growth in thinking and the slow but definite change of opinions. The Committee gradually developed the belief that science has many important outcomes to teach, that it can contribute to a good general education for all boys and girls, and that the methods the scientists use are really similar to the methods used in democratic processes. The position was taken that the most important function of science is first to

make a good citizen out of each boy or girl, therefore science must help each boy or girl to make a better living and prepare him to solve the problems which scientific inventions and discoveries have created. It, too, can make scientists of them by teaching them how to think scientifically.

I have often wished that I could find out if any other group could work so harmoniously as the science committee has done. I believe it was an illustration of real democracy in action. Surely there were differences of opinion — sometimes quite vigorous, but never a desire on the part of any member to force others to accept his point of view. It is true some talked more than others but that does not necessarily mean they were doing more thinking. The final report will not be merely the conclusions of a few people on a committee, but the outgrowth of the thinking of thousands of teachers who have made contributions. It would be exceedingly difficult to name any one person as the sole author of any single section in the reports. It is true a few persons are responsible for writing the final reports, but I am sure they would be the last persons to claim complete credit for what they have written. Certainly, all members of the Committee have been influenced by the discussions at several meetings.

I am more firmly convinced now than ever that all curricular programs should be initiated with classroom teachers. They are interested in education. They are willing and eager to work and make adjustments and changes in our educational program. They are more interested in boys and girls than they are in subject matter just for the sake of subject matter. They do not forget that boys and girls must have a large body of information if they are to become good thinkers. Teachers do not want boys and girls to have a superficial education. They also know children cannot acquire a real education by sitting in an easy chair all of the time. It is perfectly natural that teachers should question some of our new innovations in education. These innovations will soon disappear, largely because classroom teachers never had a chance to formulate them and make them workable.

In conclusion I am glad to say that all of the plans of the Committee were based on a procedure which the members consider democratic in nature. All of the deliberations were continued on this democratic basis and proved to be satisfactory although at some times not too rapid. The reports of the Committee will be approved in general by all members of the Committee although some may not agree with all parts of them. They are willing to respect the opinions of others.

Finally, I feel very fortunate in being able to work with such a group. It makes me feel proud of science teachers everywhere.

"The science courses for 'all the people's children' are built to include the aspects of science of larger concern to all people." — CALDWELL.

The "grand old man of Science Education," Dr. Caldwell, recently retired from a long career of active teaching and administration to by-no-means-inactive service as General Secretary of the American Association for the Advancement of Science. He is particularly fitted by experience to write on

Some Features of the Background

By OTIS W. CALDWELL

WHEN I was more than half my present age, my father gave me one of his old school textbooks. He said, "This book and the study for which it was the background probably influenced me more than anything else I studied in school. It seemed to provide a reasonable explanation for so many things about which I wanted to know." During his long life he often reverted to specific situations in which his thinking continued to be affected by Wells' *Natural Philosophy,* the book given to me, and which I now have before me. That book published in 1864, being the "Fifteenth Edition Revised," appearing first in 1857, carries an interesting title page paragraph: "The Latest Results of Scientific Discovery and Research; Arranged with Special Reference to the Practical Application of Physical Science to the Arts and Experiences of Everyday Life." That paragraph indicates what its old-time author thought science should do for people. My father's testimony indicates a relation, either causal or concomitant, between his eighth-grade study of science and a life-time habit of basing his ideas and opinions upon a factual and reasonable explanation of his experiences and observations.

Thus, eighty-five years ago Dr. Wells made functional claims for his *Natural Philosophy.* Comstock's *Natural Philosophy,* first published in 1843, also is reported to have helped to lay a good foundation for science for citizens. Those claims sound fairly modern when compared with statements published in the fourth decade of the twentieth century.

Many things have occurred during the almost-century since the introduction to Natural Philosophy by Comstock, Wells, and others. Scientific research, meager a century ago, rapidly became colossal. More than a score of sciences developed, some having many sub-divisions. Each developed a coherence of its own subject matter. Each acquired its own refined and exacting techniques. Each has its personnel of specialists. These specialists speak the language of their own speciality though sometimes they do not understand the language of other scientists. The accompanying growth in science knowledge was magnificent. Tremendous human benefits resulted therefrom. The name "scientific" became almost a fetish. In Chicago forty-five years ago I saw two large signs that are in point. One announced the workman as "The Scientific Shoer of Horses"; the other said, "The Scientific Undertaker." Of course, science had contributions for these callings, but the blatancy sug-

gests belief in something that had popular sales value. The public may not have understood science very well, but believed in it and accepted it in large measure.

A few decades ago, highly specialized scientists had almost stopped trying to tell the public about science in general. They advocated the specialists' branch of science as good for public education. The most authoritative educational report of fifty years ago included the statement that it mattered little what branch of science was studied by young people. It was thought supremely important that the study be rigorous, exacting, coherent, and cumulative. And meantime as the sciences underwent great growth and made great contributions to knowledge and to human comfort, their vital educative contacts did not increase correspondingly with the majority of the people. The public increased its uses of the results of scientific knowledge without a corresponding increase in its understanding of science. To accept and use the products of science without some understanding of the kinds of thinking involved in specific achievements might be somewhat better than superstitious devotion, but certainly was less than what was desired and possible. In programs of education science sometimes became dull and forbidding even while the achievements of science for human benefits became fascinating, compelling, even spectacular. The public seemed to believe in science if only its special devotees would not insist upon too much of it in too much of the specialists refinements. The curiosity and everlasting inquiry of children about open nature and the working world was often chilled and driven to hibernation when they enlisted in the science courses which were supposed to minister to curiosity and inquiry. It was like the case of the small boy who asked his mother, "Where does salt come from?" When the mother replied, "Your father is a chemist, ask him," the boy said, "No, mother, you tell me, please. I don't want to know so much about it as father would tell me."

When science was undergoing its early great advances and refinements, public education was a hope, hardly a reality. Science in the education of all citizens was regarded as a debatable question. Those who opposed the idea would cite supporting evidence from some science classrooms of half a century ago, perhaps of embarrassingly recent years. Meantime, the children of all the people streamed into public schools because of parental and community hope for whatever it is that education does for people in a democracy. The entire world had not before seen any country's young people so nearly unanimous in their search for the fruits of education. That period seemed peculiarly auspicious for larger and better uses of science in education, since this was the period during which the sciences in world affairs were becoming highly important. But those few scientists who thought about education disregarded the fact that the educational hordes wanted what education could do for many different types of later activities, among which careers in science would be a relatively small part.

A special science by its name implies a more refined division of a larger field. Or, changing the figure, a special science is like one of the upper more specialized floors of a large

structure, all resting upon, supported, and given partial security by a sound foundation. The foundation is constructed first, but takes account of the special floors that may later be built. It is at the level about which and upon which crowds of people come and go. To the upper floors there go smaller numbers of specially interested people but those also pass over or through the supporting floor. The whole structure wouldn't amount to much if it did not contain its special floors with no end of special organizations, techniques and services.

The people to be helped by science were in schools in great numbers. Several special sciences were offered them, any one of which could come first, and too often none followed. Therefore, some four or five decades ago the situation became the object of experimental study by more than a score of independent groups of science teachers who were interested in public education. Though working independently in the main, these groups soon were found to be heading in the same general direction. What they discovered now seems obvious. That is often true in the subject matter of science as well as in science teaching. The regularly-recurring experiences, needs, contacts, matters of curiosity and inquiry, home, community, shop and industrial interests as they relate to science are foundational concerns of most people. Things about which people are likely to think or about which they should think are good things with which to improve thinking. Enduring values, attitudes and interests are more likely to result from enduring and recurring topics of study. Thus, the science courses for "all the people's children" were built to include the aspects of science of larger concern to all people. These soon became foundational. The almost-universal use of such courses of instruction indicates their efficiency. The surprisingly large number of developing collateral interests, projects, clubs, papers, books, vocational choices and preparation, and students in special sciences, indicate that considerable progress has been made.

If it were the purpose of this paper to state unsolved problems, to outline objectives as now dimly perceived, to acknowledge the many weaknesses of our best efforts regarding certain problems, to list the amount of our claims which are strong hopes and not finally proved results, that is, if it were our assignment to show the work yet ahead, a long and humble paper could be written.

"The science program must be a dynamic one. Children must do something *about science."* — NEAL.

A young man of great poise and tact, Mr. Neal has not only taught effectively in the noted James Ford Rhodes High School of Cleveland, Ohio, but has given broader service in surveys of science instruction and curriculum planning in his city. He has seemed to possess wisdom beyond his years as he presided over the conferences and edited the report of

The SUB-COMMITTEE *on* PHILOSOPHY

By Nathan A. Neal

THE editor of this Science Education issue of EDUCATION has asked for a statement on: why the National Committee on Science Teaching needed a Sub-committee on Philosophy; some of the chairman's recollections of the various problems that were brought up during the Sub-committee's deliberations, and the discussions on these problems; and the broad aspects that are to be included in the forthcoming report.

At its initial meeting in February, 1939, the National Committee heard its members read prepared statements of what each considered to be some major problems in the field. There were also statements from scientists including representatives from the physical and biological sciences, a prominent geographer, experts in conservation, and a well-known medical authority. The first five sessions of the Committee were given over to these statements; discussion was limited to a few minutes following each paper. Near the close of the fifth session the meeting was opened for general discussion of the implications of the statements presented. Tentative conclusions which developed from this discussion were concerned with a different kind of training for science teachers at the various levels; the immediate and ultimate needs of pupils which are significant for science teaching; the importance of an evaluation program; and more effective administration of science education at all levels from grades one to fourteen. It was also the sense of the meeting that the Committee would be able to proceed more effectively if divided into sub-committees organized around the points for emphasis indicated above. It was then pointed out that such sub-committees, meeting as separate groups would feel the need for a unifying frame of reference. *Hence a sub-committee on philosophy, or frame of reference was suggested.* The Chairman of the National Committee then appointed a chairman for each of the five sub-committees. Committee members apportioned themselves on the sub-committees, and each group was instructed to formulate tentative plans which in turn were reported back to, and approved by a final session of this first meeting of the National Committee. Thus was instigated the work of the Sub-committee on Philosophy.

Since February, 1939, the Sub-committee on Philosophy has held approx-

imately thirty half-days or evening sessions. The membership of the Sub-committee has included about twenty active consultants who have contributed from a broad range of interest and experience in the field of science teaching. At the different meetings some four hundred pages of preliminary and intentionally varied statements of philosophy have been presented in mimeographed form. The space allowed by the editor does not permit a full discussion of all the materials which have received consideration. Perhaps the trends may be made clear by looking to some of the preliminary mimeographed material.

One list of suggestions[1] urged that the content and pupil experience in science courses should be such as to encourage and provide for:

1. Progressive growth toward definite desirable objectives related to the purposes of general education.
2. A variety of types of experiences (for a given pupil).
3. Experiences adapted to needs and interests of the group and of individual pupils.
4. Opportunity for pupils to make choices and decisions.
5. Opportunities to work alone on problems of real interest.
6. Opportunities to share and coöperate with others in small and large groups.
7. The planning and attacking of problems—using the "scientific method," doing critical reflective thinking.
8. The exchange, defense, respect, and discussion of points of view.
9. Extensive critical reading of reference books, magazines, and government and industrial publications.
10. Opportunities to construct things, try out apparatus, experiment, "make things go," work with real things or plants or animals.
11. Obtaining a "world picture."
12. The application of important science principles to everyday phenomena and to recent discoveries.
13. Interpreting data of various kinds.
14. Development of attitude of tolerance, open-mindedness, and other "scientific attitudes."
15. Sensitivity to social implications of scientific principles and applications.
16. Information and habits for individual and public health.

It was understood by all Philosophy Sub-committee members from the outset that a primary obligation of the group was to extend and amplify the *Purposes of Education in American Democracy* as published by the Educational Policies Commission. The Sub-committee accepted these purposes: (A) The Objectives of Self-Realization, (B) The Objectives of Human Relationship, (C) The Objectives of Economic Efficiency, and (D) The Objectives of Civic Responsibility, for the general guidance which they offer to all educational thought and activity, and for the specific implications which they hold for science teaching.

What contributions can the teaching of science make toward the realization of these purposes of general education? Early in its deliberations the Sub-committee attempted a brief partial answer[2] to this question:

A. *The Objectives of Self-Realization*

1. *The educated person solves his problems of counting and calculating.* Some fields of science train the individual to see his environment in its mathematical relationships. Most sci-

1 Submitted for the consideration of the Sub-committee by Dr. G. P. Cahoon, Ohio State University, Columbus, Ohio.

2 Submitted for the consideration of the Sub-committee by Dr. George Skewes, State Teachers College, Mayville, North Dakota.

ences demand a greater accuracy in measurement than is found in other fields of endeavor.

2. *The educated person understands the basic facts concerning health and disease.* The study of science trains one to seek an adequate cause for a given result, thus providing protection against superstitious notions of health and disease.

3. *The educated person protects his own health and that of his dependents.* Science gives an individual considerable specific training for health. It helps to develop health habits. It shows him the dangers from accidents and teaches him the precautions which give him safety.

4. *The educated person works to improve the health of the community.* Science teaches students the dangers of disease epidemics and the means which can be used to prevent them, thus laying the foundation for social coöperation in this field. By means of safety education the individual is taught to protect others as well as himself.

5. *The educated person has mental resources for the use of leisure.* Science study opens the doors which lead to many hobbies and leisure time activities.

6. *The educated person gives responsible direction to his own life.* The concept which a man has of the universe, his notion of who is an acceptable authority, his willingness to seek for evidence before making a decision, his tolerance toward the beliefs of others, the extent to which he recognizes evolutionary tendencies, his acceptance of physical laws as bases of explanation — all these and other things learned in science affect the ability of a person to give direction to his own life.

B. *The Objectives of Human Relationship*

1. *The educated person puts human relationships first.* The contributions of science to civilization have revolutionized the opportunities for human relationships. The social implications of scientific principles should be impressed on the minds of students. The science teacher is better able to do this at the time the principle is taught than some other teacher can at a later time. When a chemistry class studies explosives the potential use should be discussed and students should be made to feel that human relationships come first and demand constructive, not destructive uses.

2. *The educated person is skilled in homemaking.* Technological developments have decreased the daily chores which must be done in the average home, but they have brought a greater need of understanding principles of science in order to keep the home functioning properly.

C. *The Objectives of Economic Efficiency*

1. *The educated producer knows the satisfaction of good workmanship.* The projects which may be part of the science course require a combination of mental work and manual production, which when completed bring a real satisfaction to the young scientist. The work in science is definite enough so that the learner can always know the satisfaction of what he is doing.

2. *The educated producer appreciates the social value of his work.* As the science student becomes acquainted with the great industrial processes he senses the essentialness of each part of the work. If he becomes a worker in one of these chain processes he

knows that his work is as essential as that of any other worker. He will know something of the diversity of raw products needed in making even the simpler finished goods.

3. *The educated consumer develops standards for guiding his expenditures.* In this day of high-pressure advertising the consumer needs to constantly question the claims made for products. The use of a given product by a great athlete, a great movie star, or a great beauty does not mean that any person using that product will become a great athlete, a great movie star or a great beauty, even though the billboards and magazine advertisements seem to imply this. Study of cause and effect relationships in science courses should lead students to question the adequacy of a cause to produce a given result.

D. *The Objectives of Civic Responsibility*

1. *The educated citizen is sensitive to the disparities of human circumstance.* It is of peculiar importance that all the citizens of a democracy become aware of the extraordinary range of conditions under which men live. The person who has studied science will have a more nearly adequate picture of the environments of fellow human beings. He will sense their trials and will be more sympathetic in his dealings with them.

2. *The educated citizen has a regard for the nation's resources.* The problem of conservation is complex. It is patent that the attempts to conserve one resource may lead to the exploitation of another. The study of soil conservation, of conservation of energy supplies, of game and forest conservation can be carried on with accuracy and impartiality in science courses.

3. *The educated citizen measures scientific advance by its contribution to the general welfare.* The responsibility for teaching the social implications of science rests primarily on the teacher of science. The scientist must carry his research to the point of showing the probable effects of his discovery on human beings. Much of the research work in science is motivated by a genuine desire to meet human needs. For most students in elementary and secondary schools the study of science is a cultural subject.

4. *The educated citizen is a coöperative member of the world community.* Modern conditions of national interdependence make membership in the world community inescapable. The study of geography and other sciences make this fact evident. There are no national barriers where science is concerned. The great discoveries in science have come from many countries.

A modified statement of the implications of these Purposes of Education for science teaching is contained in the published report of the Sub-committee on Philosophy. The entire published report is broadly related to *The Purposes of Education in American Democracy.*

Also early in its deliberations the Philosophy group worked with a series of brief statements[3] which were somewhat epigrammatic in nature. These simple, clear, and often brilliantly stated items were organized under five different headings,[4] with each

3 Submitted for the consideration of the Sub-committee by Dr. Hanor A. Webb, George Peabody College, Nashville, Tennessee.

4 Submitted for the consideration of the Sub-committee by Dr. Otis W. Caldwell, New Milford, Connecticut.

brief statement later amplified by members or consultants of the group. The items as organized and used for discussion follow:

A. SCIENCE DEALS WITH REALITIES.

Science concerns itself with realities such as plants, animals, forces, machines, health, and many others, thus offering unusual opportunities for providing experiences through more than one of the five sensory approaches.

1. *A student should learn of a thing what it is, of a word what it means, of a concept what it teaches.*

Students should be taught that they come to recognize things and to name them according to their effect on their senses or according to their interaction with other things as perceived through the help of the senses. They should also recognize how the perception of a number of related interactions are brought into psychological association forming what is known as a concept.

2. *A student should be convinced that science deals with realities, hence observation is his method, experiment his purpose, discovery his goal.*

Students should recognize how discoveries resulting from observation and experiment in the phenomenal world increase man's command and how the work of scientists becomes cumulative through the development of a body of theory and through the advance of a tradition of scientific and technological craftsmanship.

Science education should incorporate in itself emphasis on the method of science, and the improvement of laboratory exercises.

3. *A student should train his five senses to observe — each according to his own power — in full coöperation.*

Science demands that its information come from a variety of tested sources and through numerous channels of authority. Likewise the student's experiences in science should be more than gathering facts through the eye from the printed page or through the ear from the lecturer. The learner must be encouraged to venture forth relying on his own senses to gather the facts he needs, always comparing, and critically checking his results with others.

B. SCIENCE HAS NUMEROUS IMPLICATIONS FOR HUMAN CONDUCT.

1. *Science should help students to learn to think for themselves, yet respect the thinking of others.*

Students should learn to think for themselves and to be attentive to the thinking of others. They should be encouraged to understand how it comes about that other people have values different from theirs and should respect the values of others in ways that avoid animosity and contribute most to the discovery of truth and to good coöperation.

The hope of our democracy lies in the ability of the electorate to study carefully the problems with which they are faced, the possible solutions to these problems and the qualifications of the people whom they elect to act for them in office. Amid the current flood of propaganda and ballyhoo, each individual must sift the wheat from the chaff and reach his own conclusions.

2. *A student should be willing to change his opinions and beliefs when new facts are brought to his attention.*

Students should learn to be ready to modify their ideas when they discover or are told of new facts with which

they cannot be reconciled. They should also learn to modify their modes of action accordingly.

3. *A student should be often reminded that one must practice to approach perfection; that he earns only by effort, becomes scholarly only by study, becomes accurate by being accurate, experienced by enduring experience, observant by constantly observing.*

It is the function of education to provide an opportunity for students to grow along socially accepted lines. As we think and do, so we become.

Students should be encouraged to recognize in their own experiences how their increase of competence depends upon the degree of their interest and effort, upon the range of their experience and the extent of their practice.

C. THE SCIENTIFIC METHOD IS PROGRESSIVE, BECOMING MORE REFINED WITH INCREASING INTELLECTUAL MATURITY.

1. *Critical thinking is the chief intellectual need of a democracy and therefore should become one of the prime objectives of education.*

Democracy calls upon its masses to consider its problems. The educated body of people must therefore have a sound method of thinking — not all to think alike perhaps, but all to search for the truth. The democratic school offers children experiences in solving their own problems, by collecting relative facts, observing, organizing, and testing their own conclusions. Science areas in the curriculum should offer that way of thinking necessary not only in science but in other fields of human experience.

Superstitions have persisted even among educated persons because of lack of critical thinking. If children are allowed to experiment, observe, and seek the opinion of authorities in the field in relation to problems before arriving at a decision, habits of critical thinking will be increased. There is no field with more possibilities for this type of child development than science education.

Students should be encouraged to be critical towards everything that is said to them and should react by inquiring what it asserts, what factual and what value elements are included. They should also ask upon what evidence factual statements rest. Students should also adopt critical attitudes towards procedures they see being followed in order to attain particular ends. Such criticism and especially the part of the criticism that depends upon asking whether any particular statement is supported by evidence or whether it is in accord with what is well established by evidence, can be greatly encouraged through science teaching.

2. *A student should admit that testing is an honest policy, proof a reasonable demand, and acceptance of truth an obligation.*

Much of scientific thinking and method of study is predicated on the above statement. The failure of the ancients to satisfactorily explain their environment was because they had not adopted the above procedure in the shaping of their thinking. A further caution must be exercised; that is, the concept of the truth is ever-changing.

Students should be encouraged to pursue and accept the conclusion to which the evidence leads irrespective of whether or not it is of a kind they like. They should become ready to offer proof of what they assert and

eager to demand it of others when they see grounds for doubt.

D. THERE ARE POSSIBILITIES FOR USEFUL TRANFER OF THE METHOD OF SCIENCE TO NON-SCIENCE PROBLEMS.

1. *The student should develop a desire in all of his thinking to reach sound conclusions based on evidence that he has evaluated and tested.*

After having been sufficiently curious to develop a problem and gather related materials and information from a variety of sources, the student is ready to attempt some conclusion to his work. He needs to find an answer that will satisfy his curiosity and be in line with the facts he has obtained. A student has gained a desirable habit of work when he has learned to "follow through" a problem to its ultimate conclusion.

2. *A student should be led to recognize that change is inevitable and sometimes rapid, yet many principles are fixed and unchangeable.*

Science offers unusual opportunities for the development of this concept. It is said that "truth is eternal and unchanging, only man's conception of truth changes." A careful analysis of the history of any branch of science clearly reveals the development of man's ideas concerning truth.

Basic truth is fixed but man's concept of it changes as new facts are discovered. The growth of science is marked by a series of concepts that are progressively closer approximations to the fundamental truth. The student must soon understand that as science advances its applications are likely to bring about rapid changes in our mode of living.

3. *Subjective attitudes must be recognized in thinking, for emotion as a force cannot be denied.*

Students should be encouraged to recognize, both from their own experience and from historical studies, how habit and interest influence thinking and may lead to erroneous conclusions and to important facts being overlooked or misinterpreted. Science seeks to strengthen the emotionalized activities associated with facts, principles, and critical thinking, and to weaken those emotionalized activities which are based on prejudice, propaganda, pure theory, or dogma, and all other forms of non-critical thinking.

E. ALL ASPECTS OF THE SCIENCE PROGRAM MUST BE MODIFIED IN TERMS OF THE HETEROGENEOUS GROUP, NOW PRESENT AT ALL SCHOOL LEVELS.

1. *We must provide an environment in which pupils can react constantly to life situations significant to them at their stage of development.*

The most significant experience that can be given to pupils is that of living in a democratic society. Thus the organization of the school as a whole and the science classroom in particular must be as democratic as the stage of development of the pupils will permit. Within this democratic framework problems should be studied that are meaningful enough to cause the students to desire a satisfactory solution.

The science program must be a dynamic one. Children must *do something* about science. It is only through participation in enterprises which are meaningful to them that an understanding of the subject matter of science will be acquired. First-hand experiences should supercede use of texts. Children will go voluntarily to printed material to solve their prob-

lems if the environment has stimulated them to activity that has a purpose for them.

The idea of quality in place of quantity of materials covered in the school curriculum must be emphasized. The idea of associating the length of time spent in school and school marks with real learning must be deliberately redirected.

More emphasis must be placed on the needs of the individual and the group, and less emphasis on subject matter as an organized body of knowledge. Subject matter, however, must provide a continuous background of fact, principle, theory, and experience necessary to the solution of the individual's personal, social, civic, and economic problems.

After due consideration the Subcommittee reached the conclusion that the above discussion should be included to the fullest possible extent in a statement of philosophy which was, however, to be organized in terms of a series of desirable functional outcomes of science teaching.

"THE BEST LAID PLANS . . ."

An anticipated report was that of the Chairman of the Sub-committee on the Training of Science Teachers, Dr. S. Ralph Powers of Teachers College. A sudden illness requiring hospitalization (now happily terminated) prevented the preparation of his manuscript before the editorial deadline.

"Much science teaching is carried out on a routine level with little concern for the needs of the pupil, and even less understanding of them." — CROXTON.

When Dr. Croxton, of the State Teachers College, St. Cloud, Minn., wrote *Science in the Elementary School*, it was one-third discussion and two-thirds practical activities. Such an attitude is most appropriate for the Chairman of the

Sub-Committee on Needs

By W. C. CROXTON

PRIOR to the first meeting of the National Committee on Science Teaching it was the writer's good fortune to visit many schools and to inquire of many groups of teachers what help they wished from the Committee. The answers were in no uncertain terms and showed surprising agreement. They usually included what the teachers did not want as well as what they desired. First of all, they wanted more than a philosophical treatise on science teaching. "So many people tell us what is wrong with what we are doing," they said, "but they do not tell us what we can do that is better." Many teachers stated that they did not feel that their work was highly purposeful. They asked to be supplied with more worthwhile things to do that had been developed with real children. They were especially critical of general "arm-chair" philosophy developed by persons who do not teach boys and girls.

It is easy to recognize in these requests the viewpoint of the classroom teacher. There is a tendency to see in such requests a desire for a ready-made program to be adopted. But one who is, himself, a teacher should understand the deeper significance of these desires. It is not that teachers are unconcerned about a philosophy of education and wish to adopt procedures without understanding. It is, rather, the concern, borne of experience with educational reforms, that something shall be forthcoming beyond generalities to help them to put the philosophy into operation. When the next day, or month, or school year arrives, they must carry on a program. There will be the pressure of routine and special duties, the rapid succession of classes and, in most schools, the inertia of established practices. It is small wonder that so many worthy philosophies advanced by instructors in summer courses in education and by national committees fail of fruition. And so it is not strange that teachers wish to know what help they may expect in putting the recommendations of the committee into practice.

The National Committee on Science Teaching held its first meeting in Cleveland, February, 1939, to formulate plans for work. In at least three respects the committee was fairly representative. Its members represented nearly all of the larger organizations of science teachers. It was geographically representative, the members coming from all parts of the country. It was also vertically representative of the various school levels.

The first meeting was given over to exploring purposes and organizing to attack the problems. It was the con-

sensus of judgments that the science program should be more purposefully directed toward meeting the needs of boys and girls. The committee realized that this could be accomplished only if all of us as teachers better understand and sense needs. It was, therefore, decided to organize a Subcommittee on Social and Personal Needs in Relation to the Science Program as a part of the efforts of the National Committee to work with and through teachers at all levels.

The task of assisting in the redirection of science instruction is, however, broader than the study of needs. Needs are conceived in the light of a philosophy. Again, one may sense needs and have a consuming desire to be helpful, but lack versatility in suggestions for procedure. Effectiveness in meeting needs is partially dependent upon suitable teaching materials. Evaluation is an inherent part of teaching and it is highly desirable to know whether important objectives are being attained. Much of the success of the efforts to redirect science teaching along more purposeful lines depends upon the education of teachers. Finally, it is necessary that the program be fitted into the school organization. To attack these problems, the National Committee organized other sub-committees. The work has, therefore, proceeded through several subcommittees under the general direction of the National Committee.

The Sub-committee on Needs in Relation to the Science Program has been asked to make its findings available to teachers. This will be done in a forthcoming publication, entitled, "Redirecting Science Teaching in the Light of Personal-Social Needs." The report briefly describes the project, presents suggestions for discovering needs, and includes checklists of some desirable outcomes of science teaching at the various school levels. It also suggests a method of integrating the efforts of all teachers through the use of common goals. It is in no sense a report of a finished task. The checklists, which constitute the major portion of the report, have been developed through the coöperation of thousands of teachers in many schools throughout the country who have been studying the needs of their pupils.

In each of the coöperating schools the purpose of the teachers has been to improve their own programs. The sub-committee has acted mainly as the coördinating agency, providing suggestions for studying needs and making available to the teachers the findings of other groups. As functional outcomes based on needs have been set up and submitted by coöperating teachers, these have been mimeographed and made available to all schools for study and validation in terms of their own pupils. In this manner a checklist of functional outcomes based on reasonably predictable needs has been accumulated. In making it available now to all teachers through publication, there is no thought on the part of the sub-committee that it is to be adopted as the goals of their science teaching. Rather, it is hoped that it may serve other teachers in somewhat the same manner that it has served those of us who have thus far participated in the study — as a means of increasing sensitivity to needs. Perhaps, this is best expressed by a brief quotation from the introduction to the report, "One of its most notable features has been the gradual growth in insight on the part

of all of us into the needs of individuals and of our democracy."

An encouraging feature of the undertaking has been the enthusiastic efforts of the many sub-committee members, coöperating teachers, parents, and school officials. In the joint efforts of all of these lies the hope for a more purposeful and functional science program. During the later phases of the undertaking several parent groups aided by validating the list of outcomes and offering suggestions. Reports reaching the committee indicate that participation by parents in determining the outcomes of instruction proved a most effective means of educating them in the purposes of the schools and enlisting their enthusiastic coöperation. At the high school level several groups of pupils aided in determining objectives based on their needs as they understood them. Both of these phases of the undertaking are worthy of much wider development by the committee and application by teachers in formulating their objectives.

From the point of view of research in science education the study is open to the criticism that the teachers were not supplied with adequate techniques for discovering needs. Undoubtedly this would have greatly increased the value of the undertaking. At the outset, the sub-committee intentionally avoided suggesting needs and desirable outcomes. Once the work was well underway, it required all the time to make the findings available that the busy committee members could devote to the undertaking. The development of suitable techniques for studying needs is probably one of the most fruitful fields for future researches.

The development of a functional program is a process of evolution, not of revolution. Some of our science teaching is highly purposeful. Much of it is potentially useful. Undoubtedly much of it is still carried out on a routine level with little concern for the needs of the pupil, and even less understanding of them. Fortunately sensitivity to needs can be developed as can other abilities. Here then is our starting point if we are to make through science area in education the contributions which the importance of science in living today so clearly indicates.

"Science has been taught in the past too much as science for the scientist, and too little as science for the citizen." — EBEL.

The exceedingly practical demands made upon Mr. Ebel as a young but experienced instructor in the Edison Institute High School, Dearborn, Mich., are reflected in his services as Chairman of

The Sub-Committee *on* Effective Procedures

By ROBERT L. EBEL

NO new program for the teaching of science can be effective if it ends with a statement of goals to be achieved. For, important as the clear and detailed statement of goals may be, what goes on in the classroom determines the success or failure of a program. Educational goals are more like architects' drawings than they are like gardeners' seeds. They do not contain within themselves the capability of self development. They do require the painstaking labor of many men for many days if they are to reach fulfillment. The National Committee on Science Teaching, recognizing these facts, has delegated to the Sub-committee on Effective Procedures the job of searching out or developing methods of instruction which will effectuate its program for the teaching of science.

Since the initial meeting of the Committee on Effective Procedures in Milwaukee in June, 1940, we have asked for and received scores of descriptions of effective procedures. These have varied widely in form and content. The form in which the procedure is described, whether as course outline, illustrative lesson plan, or simple narrative, is immaterial. The content of the description is vital. It must show how the philosophy of this committee can be carried into the classroom. A few of the descriptions already submitted fit this requirement admirably. Others, aimed at the older concept of science as logically organized subject matter to be learned, were wide of the mark.

At this point a very important question arises. What is the program of the National Committee on Science Teaching? What are these goals which we are asked to achieve? Is the viewpoint of the committee progressive or conservative? The answers to these questions are not simple. Hundreds of thousands of words written by the members of the Sub-committees on Philosophy, and on Functional Outcomes, have been condensed into tens of thousands in their final reports. In the short space of a single paragraph we can hardly hope to adequately represent the program of the National Committee. But we must at least outline that program if we are to make clear what we mean by effective procedures.

The fundamental goal in the program of the National Committee is that of *meeting life needs through science teaching.* The committee is so thoroughly convinced of the tremendous importance of science in the modern world, and of scientific information to the modern citizen, that it recommends a continuous program of

science teaching from kindergarten through junior college for all students. The committee feels that science has been taught in the past too largely as *science for the scientist,* and too little as *science for the citizen.* It is therefore recommended by the committee that science be taught to meet directly, not incidentally, the personal and social needs of the individual. This implies science teaching in which definite efforts are made to determine the pupil's personal needs, and to determine how science can better serve the needs of the community in which the pupil lives. It further implies that science teaching should not avoid the consideration of controversial topics, such as the relation of science to religion, racial differences, or the economic implications of scientific advancement. It implies that science cannot be satisfactorily studied from *a book* within *a classroom,* without reference to the life of the individual and community outside. The committee feels, further, that the job of education for effective participation in a democratic society is part of the responsibility of science teaching. To this end, it recommends democratic classroom procedures, in which pupils have a part in determining class activities, in controlling pupil participation in those activities, and in evaluating progress. Finally, the committee re-emphasizes the importance of the scientific spirit to the individual, and recommends that the student learn, through actual practice, how scientists solve their problems.

The Sub-committee on Philosophy has listed nine principal areas in which science teaching can contribute to better living. These are, health, safety, recreation, work, consumership, conservation, social-economic action, inter-personal relations, and maturing philosophy of life. The Sub-committee on Functional Outcomes has listed several hundred specific abilities to which science teaching can contribute. For example, in the area of health on the high school level, the committee list includes, "Ability to use aseptic methods and to use antiseptics and disinfectants intelligently," and "Coöperation in the movement to secure passage and enforcement of adequate food and drug legislation to protect public health." It is quite obvious that all of the currently separate high school sciences can contribute to the development of abilities such as these. This raises the question as to whether the program of the National Committee requires the reorganization of science teaching so that the so-called separate sciences disappear to be replaced by courses in health, safety, etc., or by generalized courses in science for personal and social needs. The Sub-committee on Effective Procedures decided, after considerable discussion, that it would be possible to achieve the committee objectives under both types of course organization, and that it would be unwise for the committee at this time to take a stand favoring either type of organization.

Another extended discussion within the sub-committee centered around the probable effect of the National Committee's program on the preparation of science teacher. With the emphasis on meeting personal and social needs, our program, some felt, was beginning to look like a course in the social studies. No one objected to the resemblance in itself, but some did feel that a hard-pressed school administrator might seize upon the program

as justification for placing the teaching of science in the hands of one with abundant preparation in the field of sociology, and meager scientific preparation. It was finally decided that the recommendations of the sub-committee on teacher training should be depended upon to adequately handle the situation.

It should not be surprising that the discussion of procedures for teaching in the field of controversial issues should provide some controversy within the committee. Testimony by committee members indicated, for example, that evolution is by no means a settled issue in many sections of the country, and that while sex education has been handled successfully by many teachers in many situations, it is potential dynamite in others. The sub-committee felt in this, as in similar cases, that any attempt to make sweeping "national" recommendations would be foolish, and that what the science teacher does with respect to such problems as these must be determined largely by the situation itself. Such a decision is, in fact, in line with the general policy of the National Committee that science teaching should be geared to the particular needs of the individuals and community being served. On the other hand, fancied community opposition should not be used as an excuse for restricting the effectiveness of the science program, nor should real community opposition be taken as an absolute and final "no" to suggestions for vitalizing the teaching of science. Communities, like individuals, can be educated.

Soon after the formation of the Sub-committee on Effective Procedures, it became apparent that some work which was being done in the Evaluation Sub-committee on methods of teaching was closely related to our work on effective procedures, and that work was transferred to the Procedures Sub-committee. Yet the work of this group could not be easily merged with that being done by the Sub-committee on Effective Procedures. For, instead of attempting to devise or discover new teaching procedures, the evaluators had been seeking to make better use of the techniques already well established. This work was based upon the following premises.

(1) An abundance of excellent techniques for the teaching of science is available to the well-informed and progressive teacher.

(2) No single technique nor logical system of techniques will yield best results in all situations. Effective teaching requires the use of a wide variety of techniques, and the intelligent choice of particular techniques to fit specific situations.

(3) New philosophies and changing points of view in education are not likely to revolutionize teaching techniques. There will certainly be additions, improvements and changes in relative importance, but such established techniques as the assignment, the demonstration, the class discussion, the project and many others will be with us for years to come.

(4) Great improvement in teaching will result from a study of the individual characteristics and best use of available techniques.

The evaluation group had already prepared a list of the principal techniques of teaching known to them, and outlined the general characteristics, advantages and weaknesses of each. These outlines were distributed to several hundred teachers of science in va-

rious parts of the country for study and comment. The outlines were being revised in the light of these comments when the group became a part of the Sub-committee on Effective Procedures. That work is being continued, for it is the conviction of the committee that whatever the new directions or emphases in science teaching as a whole, these same techniques will still need to be chosen wisely and used well.

Another group, working in the area of supplementary teaching devices, such as science fairs, science clubs, and science assembly programs has recently been added to the Sub-committee on Procedures. Beginning their work as a part of the Sub-committee on Science Teaching Materials, this group is in the process of assembling a store of valuable information on the effective handling of supplementary science activities.

The discovery or development of effective teaching methods to put into effect the program of the National Committee on Science Teaching remains, however, the principal problem of our sub-committee, and it is to this problem that we now direct attention. The following is an illustration, based partly on fact, partly on fancy, of a teaching procedure which might meet the conditions laid down by the National Committee; namely of being (1) democratic in plan execution, (2) designed to meet direct personal and community needs, and (3) based on real life experiences outside the classroom.

During the study of a unit on conservation in a tenth-grade biology class, a pupil expressed his disgust with the condition of a stream which flowed through the community. It was, he pointed out, a sluggish, dirty, badly polluted stream, unfit for swimming and with only a few carp as inhabitants. No one disagreed with his opinions, but none could suggest what might be done to improve the situation. A hint from the teacher that this class might undertake a detailed study of the river, with a view to gathering actual facts about the river, and of presenting them in such a way that it would call community attention to the problem, was enthusiastically accepted. Several periods were spent in planning the work with the class. One of the first suggestions was that the class take a field trip by bus to half-a-dozen easily accessible and representative spots on the river, in order to get a true picture of the whole. One group was designated to secure a map of the region and plan the route of the trip. Another was chosen to secure water samples at each stop. Still others were selected to measure the turbidity and rate of flow of the water, to secure soil samples from the river bed, to collect specimens of plant and animal life, and to make photographs of the environment, and of the class at work. After a number of disappointing postponements because of the cold, rainy weather of late October, the trip was made successfully. By class sentiment, each student was held responsible for the performance of his chosen task.

Back in the classroom, the pupils began to make use of the materials gathered. Previously prepared agar slants were used to obtain a rough measure of the bacterial content of the water samples. A large map, showing the area drained by the river and the route of the trip was prepared. Measured samples of the water were fil-

tered, and the soiled filter papers were mounted, with explanations, on a poster cardboard. The pictures taken were developed, enlarged, and worked into an attractive layout.

Meanwhile, work had been going forward along other lines. The question of sewage pollution came up, and the class decided to make a trip to the near-by disposal plant to see how the sewage of the community was handled. They found that the sewage is clarified, and the oxidizable matter reduced to a safe value, but that the bacterial content is not greatly affected. One group undertook to prepare a flow-sheet of the disposal process as used in the plant.

In an effort to secure further information concerning the condition of the river, the class called upon the local commissioner of public works, and upon the regional conservation officer to come to the class and discuss the problem with them. They learned that it was not the city itself, but outlying communities and institutions which were largely responsible for the pollution, and that farmers tile drains and the cultivation of the direct watershed of the river were the cause of much turbidity.

Old residents of the community were interviewed to find what the river once had been. One group of students became interested in the prehuman history of the river. They studied the geological forces which shaped the river, which made it for part of its length a "drowned" river, and which accounted for its sluggishness. Two of the boys made a canoe trip from well up on one of the branches of the river to its mouth, and recorded their observations in detail. Another pair used geological survey maps to prepare an accurate relief map of the river basin.

At the annual school exhibit, all of these projects were organized into a unit designed to call attention to the condition of the river and its causes, and to suggest some possible remedies. Articles in the local paper served further to awaken interest in the problem. On their part, the pupils felt the satisfaction of having learned a great deal of practical biology in connection with a worth-while community and personal problem.

We stated at the outset that the foregoing account was based partly on fact and partly on fancy. Actually the project did not work out as nicely as it was planned. Projects seldom do. But there is nothing in the account which we did not definitely plan or attempt to do. There may be those who would criticize the presentation of an idea which had not proved wholly successful. Yet we are not willing to admit that the faults that appeared were faults in the fundamental idea, nor that the partial failures were inevitable. Rather would we charge them to insufficient planning and preparation, to lack of time and its universal companion, lack of effort. Judged on the standards of pupil inspiration, interest, and participation, it was incomparably superior to anything else that we had done.

Let it further be made clear, perfectly clear, that the illustration is not presented with the dictum, "Go thou, and do likewise." Rather it illustrates an attempt to put into effect the re-directed program of science teaching of the National Committee. Better work can be done. Better work will be done. The Committee on Effective Procedures needs your help on this job. May we hear from you?

"Reports from parents concerning many of these outcomes [of teaching] would seem more valuable than reports to parents." — PRESTON.

There is no substitute for experience in setting values — hence the long service of Dr. Preston, Division of Teacher Training in the University of North Carolina, Chapel Hill, N. C., qualified him to initiate the plans of

The Sub-Committee *on* Evaluation

By CARLETON E. PRESTON

THAT the Evaluation Sub-committee was one of the five first set up was due mainly to the pre-planning of the general chairman. Although the need for it would almost certainly have been felt as the study progressed, at the time of its formation no such point had been reached, and the sub-committee — its leader rather drafted into that service than eager for appointment (since his major work and interest were in the field of teacher education) — started out with extremely faint notions of the part it was to play in the general study.

The group realized at the outset that nothing more than ground-clearing work could well be done until certain other sub-committees had reported in form sufficient to establish definite direction to the whole study. A guiding philosophy had to be enunciated and afterwards translated into concrete objectives that might serve as evaluation criteria. That the sub-committees dealing with these aspects of the study would be anything more than preliminary and short-lived could not then be foreseen.

The group started with the question, what things need to be evaluated? A certain sub-group showed particular interest in evaluating, after attempted classification, various formal methods and techniques of teaching; but progress here, for lack of established criteria, was limited to determination of the various general strengths and weaknesses of each method independently. Subsequently, a special Sub-committee on Methods was established, and withdrawn from the evaluation group. Almost an identical course was that taken in establishing a Sub-committee on Materials, resulting in the loss to the Evaluation Sub-committee of other active workers. A third interest shown was in teacher qualification. Are there any characteristics essential for science teachers that are not essential for teachers of other subjects? For example, is mechanical aptitude in a certain degree a *sine qua non* of a successful physics teacher? It soon became apparent that this problem overlapped that of the Teacher Education Sub-committee, and should be dropped. One or two persons especially interested in it then transferred to the other sub-committee simultaneously with the problem transfer, or abandonment.

Thus successive steps were taken toward closer limitation of the field of our sub-committee work. At the same time, the separating of the new groups, under chairmen originally

members of this sub-committee, deprived us of several able and active workers. We have missed their strength.

Another line of approach undertaken during this preliminary period by a portion of the sub-committee was an investigation of present "achievement" tests in science, in the hope that this might ultimately lead to improvements in their construction, so far as they may be used in future. Analysis of the average published achievement test discloses questions of many different kinds and qualities. Some call for no more than substitution of a scientific term for a perfectly good term in common use; some are ambiguous; some quibble about terminology; some require information not actually obtainable with certainty, so that the pupil's success depends on his agreeing with the opinion of the test-maker; some call for recognition of one of the many significant types of relationships that exist in science study and in nature; some deal with problem solving; some call for judgment in interpreting data — questions good and poor in form, valuable and relatively worthless in content, concerned with testing this or that ability or no ability, are all thrown together rather promiscuously in one single testing instrument.

What can such an instrument really test? What are the really significant and valuable factors in this composite which we have been calling "achievement"? Can better practices, both of question formulation and of test organization, be built up and made prevalent in the construction of tests both for home use and for market consumption, to evaluate attainment of these factors, once determined? What objectives can be satisfactorily evaluated by paper and pencil tests? Do we need special tests of this sort, newly designed, to cover certain particular objectives not now adequately singled out for evaluation as to degree of their attainment? Can criteria be established by which relatively worthless test questions can be detected and ruled out, and others be made more purposeful? These are some of the problems that teachers generally have still to solve, and upon which the present Evaluation group has made, and can make during its short existence, only a very tentative beginning. It must be remembered that so much as was done was undertaken pending the appearance of the reports of other sub-committees, which, if the work of the committee as a whole is to possess unity, should naturally determine the final direction of the evaluation work.

Considerable time passed before the lists of Desired Functional Outcomes appeared even in preliminary form; but when they did, a new approach to evaluation was made possible. As yet, it has hardly more than started.

It will be noted that the outcomes on these lists are all phrased (correctly, so we think) in terms of *abilities, tendencies, attitudes, habits, desires, feelings of responsibility or of concern,* and the like, each one of which, with few exceptions, connotes an emotional as well as an intellectual response. It will be apparent that attainment of relatively few of these outcomes can be measured by paper and pencil tests. It will be also apparent that the efficiency of the instructional program and methods can best be evaluated through the degree of attainment of the objectives set; in

other words, through the character of the product.

A promising method of attack upon this problem seemed to be that of first setting down in column the separate items of the Outcomes lists and opposite each one recording potential means of its evaluation as to attainment. One or two examples follow:

Ability to preserve foods	Product exhibited. Reports of Home Economics teacher, 4-H leader, parents. Pupil's own report of methods used. Formal tests on principles.
Civic concern for observance of safe driving regulations	Anecdotal record of pupil's actions and of his comments on the actions of others, gathered from teachers, fellow-pupils, parents, police, others.

From sufficient studies of such analyses, made by individuals and by groups, it might be possible to derive generalizations that would point the way to more significant and desirable practices than are common today.

To date, this writer knows of only one brief study of this kind, his own, which he prepared merely as a tentative sample. The generalizations drawn from it are therefore as yet insufficiently supported to be of great weight; yet some of them may have a sufficiently stimulating effect to bring about further study so that inclusion of them in this report may be warranted:

1. Except for the outcomes listed under "Maturing Philosophy of Life," formal tests, either written or oral, can play only a small part in real evaluation.

2. Of the categories of outcomes, "Maturing Philosophy of Life" has been the one most stressed to date in the average science course. The prominence it has had may be quite justified, since in considerable measure it seems to aid in determining attitudes in the other categories mentioned. But in teaching and testing, too much emphasis has been put upon memorization of minor details and too little on the attainment of an orderly and consistent "world picture," with real understanding of major generalizations necessary thereto.

3. The habit of clearly defining ideas, and of fitting ideas together in ways to discover new significant relationships, has been insufficiently emphasized as a step necessary to gaining this "world picture."

4. A far greater degree of coöperative contact with parents than now prevails is desirable. Reports *from* parents concerning many of these outcomes would seem more valuable than reports *to* parents.

5. Schools need closer link-up with other community agencies, both for instructional and evaluative purposes.

6. Coöperation among all departments within the school is needed. The individual, not the subject, is the center of effort.

7. Though objective and quantitative measurement is desirable wherever it can be used, most of these outcomes permit its use only in slight degree; therefore other types of evaluation must enter largely. Anecdotal records seem to be needed in many situations.

8. There is room for the construction of a variety of types of special testing instruments for particular purposes, in areas not now provided with such instruments.

9. There is also room for much study of the best methods of collecting data from extra-class and extra-school agencies, and of making it available to teachers concerned.

10. More and more the pupil himself, as he matures, needs to become a partner in evaluating his own progress.

A word in conclusion: This writer feels that not the least of the values of the work of his sub-committee, as of the General Committee, has been the stimulating of local studies of many kinds in widely scattered parts of the country, and the bringing together for more concerted attack upon science teaching problems a great body of teachers throughout the nation. Records of work started apparently through the influence of this Committee have been received from points as far apart as Pasadena, San Antonio, and Washington, D. C. Numerous magazine articles have appeared already which, though they do not bear the official mark of the committee, have none the less been indirectly in greater or less degree a product of its activity. The importance of this phase of its usefulness should by no means be overlooked in making up the final balance sheet.

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As Supervisor of Science Instruction in the Detroit, Mich., Public Schools, Mr. Massey has abundant opportunity to discover which aids to science teachers are good, better, and best. He is therefore a most dependable Chairman of

The Sub-Committee *on* Effective Materials

By EMIL L. MASSEY

THE preliminary organization of five sub-committees of the National Committee on Science Teaching failed to include a consideration of one of the most important aids to science instruction, i.e., materials. Therefore at the second meeting of the National Committee on Science Teaching, which was held on May 12-13, 1939, in the Cleveland Hotel, Cleveland, Ohio, a new Subcommittee on Sources of Free and Nominal Cost Materials was formed. This committee held its first meetings at the Stevens Hotel, Chicago, Illinois, on Friday, October 6, 1939. The name of the committee has been changed to Materials for Science Teaching.

These first meetings of the Committee were devoted to an exploration of the area of the materials for science teaching in an attempt to define its purposes, functions, and scope, and also to plan the first steps in securing a list of pertinent problems which might engage the future efforts of the group. The committee concluded that it should function largely in attacking the problem of materials which will eventually grow out of the deliberations and final reports of the other sub-committees. In the meantime, the committee agreed on the following purposes: (1) To attempt to locate the areas in the field of materials in which teachers were experiencing difficulty; (2) To make a list of additional problems suggested by teachers; (3) To find promising solutions for these problems.

In its preliminary discussions the committee recognized the following areas in the field of materials as offering some promises for study:

1. Reading materials.
2. Science institutions, museums, etc.
3. Visual aids.
4. Clubs, science fairs, assembly programs, etc.
5. Scientific societies.
6. Radio, television and recordings.
7. Equipment and supplies.
8. Textbooks, laboratory manuals, workbooks, etc.

The committee agreed that the limitations of time and finance would preclude the collecting of detailed list of materials, bibliographies, etc., or making exhaustive studies of all problems presented. It was agreed that the efforts of the Committee should be aimed at directing and suggesting materials and sources of materials and toward influencing the production of

new materials to meet the needs of science teachers.

The committee's problem between this and next meeting was to prepare and distribute a preliminary form of inquiry sheet involving various problems based on the above listing of areas. This would furnish a basis for further planning of work.

Immediately following the Chicago meeting, a questionnaire was developed and sent out to fifty consultants in thirty-four states. About one-third of these were returned and the results tabulated by committee members at the St. Louis meeting which was held on February 22-23, 1940.

Following the completion of the tabulation there was extensive discussion of how the results thus obtained could best be utilized to bring about the desired results. It was decided that best results would be obtained if the various areas in which new materials might be available were reassigned and that members of this subcommittee would then be assigned specified divisions for which they would be held responsible. Further these various chairmen would use the materials that had been gathered by the inquiries and further investigate their specific field for materials that would contribute to the educational outcomes stated by the Sub-committees on Philosophy and Needs.

The areas of investigation were redesigned and chairmen appointed as follows:

1. Reading Materials.
2. Visual Aids.
3. Radio, Television and Recordings.
4. Textbooks, Laboratory Manuals, and Workbooks.
5. Laboratory and Demonstration Materials.
6. Science Clubs, Fairs, and Assembly Programs.
7. Science Institutions, Museums and Societies.

Each chairman was instructed to try to get consultants to work with him from each school level, i.e., elementary, junior high school, senior high schools and junior college, and also to try to get representatives from rural, village, town, small city, and large city school systems.

An extensive discussion then ensued as to what the scope of these new subdivisions would be. Many suggestions were offered by those present. Some of these were passed on to the subdivision concerned and others were discarded because of an overlapping into the work of the Sub-committee on Procedures. The suggestions may be summed up by saying that prior to the next meeting of the General Committee, the chairmen of the sub-divisions of this Committee on Materials will gather extensive information as to needs, sources, and solutions of problems that will exist in carrying out the program that is suggested by the Philosophy and Needs Committees.

There was a poor attendance of members of this committee at the Milwaukee meeting June 28-29, 1940. However, there was some discussion of the work of the sub-divisions on Textbooks, Workbooks, and Laboratory Manuals; Science Clubs, Fairs and Assembly Programs; and Reading Materials. At this meeting the subject of the standardization of laboratory furniture was introduced. Discussion followed about the type of furniture best suited to all needs and the feasibility of making suggestions on size

of laboratories and types of furniture.

During the meetings of the Central Association of Science and Mathematics Teachers in Cleveland, Ohio, November 22-23, 1940, a group of General Committee members and consultants got together to discuss further the question of standardized laboratory furniture. The idea of one type of furniture for all schools was severely criticized but it was decided to make a further study of the problem.

The last meeting at which committee members and consultants were together as a group was at Atlantic City, New Jersey, February 19-21, 1941. Reports were given by the various sub-division chairmen followed by discussion and plans for the final report discussed.

1. Reading Material. — This subdivision has assembled a large quantity of reading materials from various sections of the country. This material has been listed to show cost, title, publisher; whether it is a book, bulletin, pamphlet; grade level, branch of science (Physics, Chemistry, Biology, etc.) and which one of the needs, as set up by the Needs Committee, the material meets. This report is so voluminous that the sub-committee feels that, in the final report, we will necessarily be limited to giving only sources of reading materials and leave the final decisions on placement and use to individual school systems.

2. Visual Aids. — The chairmen of this sub-division sent in written reports which were discussed by the group and from which the following conclusions, as to the final report, were made: We should make a very complete compilation of sources of Visual Aids such as charts, films, the two sizes of slides, projection equipment, etc. This should show whether the material is to be purchased, free, or rented.

3. Radio, Television, and Recordings. — The chairman of this division gave a report on what has been done in this field and suggested that we list school systems that are successfully using radio and recordings in science teaching and that we suggest a plan which might be followed along this line.

4. Textbooks, Laboratory Manuals, and Workbooks. — The work of this division will necessarily follow the final reports of the Philosophy and Needs Committees.

5. Laboratory and Demonstration Materials. — This group has worked earnestly to get information from most of the State Departments of Education, and from this material and other sources have been assembling laboratory and demonstration procedures and methods. This again has become so voluminous that the committee believes that the final report will need to be confined to a complete list of sources of materials. Several laboratory materials companies have given assurance of coöperation in supplying needed materials. Again the subject of standardized furniture was discussed but ended in no definite agreement.

6. Science Clubs, Fairs and Assembly Programs. — This group has transferred to the Procedures Committee.

7. Science Institutions, Societies and Museums. — It was suggested that the work of this group also belongs with the Procedures Committee.

The members of this sub-committee feel that a large portion of the work has already been done by science or-

ganizations, school systems, individuals, etc., and that the committee's job is to report these sources of information on materials. They also hope to influence producers to develop new materials to fit in with the recommendations of the National Committee on Science Teaching. Another responsibility will be to encourage science teachers journals to continue the work of reporting and evaluating new materials, as they come on the market, in the light of the new philosophies in science teaching.

SERIES OF CURRICULUM UNITS ANNOUNCED

The University of Oregon Curriculum Laboratory has published a series of Curricular units for use in elementary and secondary schools. Some bulletins in this series are: *The Adventures of Puck,* (Midsummer Night's Dream No. 25, 60c); *Robin Hood,* (No. 26, 50c); *Brazil: A Land of Opportunity,* (No. 27, 50c); *Bread,* (a second grade unit-No. 8, 25c); *Pets,* (a first grade unit-No. 9, 15c); *Clothing,* (a third grade unit-No. 10, 20c); *Local and Pioneer History,* (a fourth grade unit-No. 14, 20c); and *Interdependence of Plant and Animal Life* (a high school science unit-No.12, 30c).

Each unit contains an overview, suggested approaches, research activities, pupil and teacher references, evaluation techniques, correlations, and other teaching aids. They may be secured from the University Cooperative Store, Eugene, Oregon.

"To educate the children of today is hard work." — TEETERS.

The keen analyses of plain-speaking Mr. Teeters, Supervisor of Physical and Biological Sciences of the St. Louis, Mo., Schools, have often brought discussions in Committee to a focus. Here he presents some comments — complimentary and otherwise — on the question

What Of Supervision?

By W. R. TEETERS

IF the reader is exploring the literature for some new theory or for a solution of the problem of educating the present and coming masses of children he would do well to pass this article and search elsewhere. On the other hand, if he wishes to acquaint himself with some of the current problems, especially those of a practical nature, it may be possible he will find some new angles of approach to old situations.

Someone has said that supervision is the improvement of instruction. This is certainly a legitimate aim. Everyone is interested in the improvement of instruction. The Board of Education of any community is certainly interested. They proceed to employ a superintendent of schools who is to direct and supervise the instruction of the children. In turn he appoints his assistants, and assumes the supervision of the principals and teaching corps. It may be he will be able to appoint some principals and teachers, but on the whole he must work with the material he inherits with the position to which he is appointed. In most of the larger places and in many instances the smaller ones, he is also blessed or burdened by a very special group commonly known as supervisors. Why this group was so unhappily named is still a mystery to the writer. It was probably so named to set it aside from other groups interested in the same general objective. Nevertheless, the name is not popular either with its owners or with those who come in contact with the owners of it.

Let us now, in brief retrospect, see just where we are and where we are going. We have set up the average school personnel — the board of education, the superintendent, the principals, and the supervisors. All these groups propose to help educate the children of the community, yet they do no teaching. How do they function? Anyone in the school business knows what happens. They all direct their attention to the only group which is left, namely, the teachers. To be sure, the superintendent either directly or indirectly checks down the line, but the good superintendent knows his system can be no stronger than his teaching corps. He is usually picked for his educational background, his ability to meet the public, for his poise and dignity, and his general understanding of humanity. This is good. The superintendent sets the tone of the system. The majority of subordinates are quick to catch the spirit of his policies. The teachers are not the last to coöperate. They learn quickly and enter with vigor into the spirit of the policies set up. The superintendent, no matter how large the system, gets into the classroom occasionally. He may make suggestions for improvement of the teacher work or compliment her for work well done. The

teacher has had a visit from the superintendent. She may have been a little ill at ease but after it was over she was glad it happened because she was inspired by a remark or a casual comment made by the superintendent. The assistant superintendents must also see the teachers and help improve instruction. So they visit the teacher occasionally. They may or may not comment but like the superintendent they are tactful and helpful. The teacher has had visitor number two. She is pleased.

The next in line to direct or misdirect the teacher is the principal. The principal is a supervisor as well as an administrator. These parallel duties will be discussed later. Most principals have secured their ranking because they have prepared themselves for such positions and show themselves to be leaders in the field of education. There are principals in positions, however, who do not measure up to the standards set for such positions. We will not attempt to derive the formula which put them in these places. Most teachers are devoted to their principal and rightly so. He is helpful, inspiring and sympathetic. He understands the teacher's problems and lends himself to their solution. He is, or should be, the teacher's most important visitor — he is number three.

For some reason, which many are unable to understand, the principal has been given almost unlimited powers within his own school. As a result, some principals set up a dictatorship which is unrivaled even in the land of dictators. For example, in the elementary school he may be a reading enthusiast, or he may devote his time and attention to arithmetic or to geography. Be that as it may, the result is that a well-balanced unit of instruction does not exist. In addition, he rules his faculty with an iron hand and they must teach and develop his ideas which are not conducive to a well-balanced education for the children under his supervision. Most all of us are interested in keeping abreast with current thought and practice in education pertaining to our respective fields either by attending schools of education, or taking part in educational movements sponsored by the N. E. A., or attending workshops which are set up for study in the various parts of the country during the summer. Teachers go to schools for the express purpose of improving themselves. They come back from their endeavors full of enthusiasm and with ideas and plans for improving their work. If their principal happens to be of the dictatorial type just described the teacher soon finds that the peak of enthusiasm is leveled and made to conform with the old ideas of the principal and the result is that there is no improvement of instruction. All the teacher can do is to burnish her earned semester hours and put them on a pedestal in the back of her mind. She can look at them from time to time through her mind's eye and get what pleasure may come from the fact that she has tried to improve herself. The one bright side of the whole affair is that most principals do appreciate the efforts of their teachers, and the condition just outlined is the exception and not the rule. Principals are responsible for their schools and the kind of instruction offered in them, but who is to see that the correct type or at least not an antiquated type of instruction takes place. In any system of size the superintendent and his assistants can only give partial attention to existing conditions. They are

overloaded with other duties and the cry of many systems is "keep down the overhead." As a result what happens is very much in the hands of the principal. If he is a good principal the results are good — if he is not a good principal the results are correspondingly not good.

We now come to the supervisor, who also may visit the teacher. If she is in the elementary school, the visits are numerous. To mention only a few, she is visited by the art supervisor, the social science supervisor, the language arts supervisor, the science supervisor, the physical training supervisor, the music supervisor, and so on. Each supervisor has a program and each one tries to put over his program and these are the sticks, not straws, that broke or are breaking the proverbial camel's back. Everyone is aware that the supervisor is not held in high regard by many teachers and principals. The idea of supervision is good, but in many cases the practice is bad. The supervisors have no one to blame for their present predicament other than themselves. In most cases they have tried to force programs of instruction on the teacher and these programs have had to be executed in a definite manner and with dispatch. The supervisor in many cases becomes demanding and dictatorial in manner, insisting that his instructions be carried out, and this conflicts with instructions of the principal. As a result the poor teacher is between the devil and the deep blue sea — and she does not know which is the devil, the deep blue sea being preferable. No wonder the teacher rebels — anyone with a half ounce of spirit would do so Since the principal is always present it is the better part of valor to support him.

Another unsolved problem, at least for the writer, is the sharp line of demarcation educators draw between administration and instruction. In some places the chasm is so wide and so deep that it sets up an unsurmountable barrier for instruction to cross to administration, but permits administration to cross to instruction at will. Obviously this slows down the machinery for educating the child. The supervisor, theoretically, is one who must never attempt to cross this abyss, yet there are a few who are ferried across due to seeming necessity. The science supervisor is one of them. Let us look, for a moment, for the reason of such a concession. In any large system there is considerable apparatus to be kept in repair, inventoried, and new apparatus purchased. This is especially true at the higher levels of instruction. Supplies are to be purchased in large quantities. The listing of authorized supplies and equipment must be made for the use of the teachers. A check must be kept on orders so that some teachers do not order in excess. Inventories must be checked to see that new purchases have been added and that this year's inventory is not simply a copy of that of the preceding year. These things cannot be done by the principal of a large school. He is usually so busy he seldom gets into the classrooms of his own school. This activity should be coördinated for all schools of the system. No one is in better position to do this and no one knows the field better than the science supervisor. In most places this has been recognized by superior officers and the assignment has been made. A good science supervisor in a large system can save his Board of Education more money than his salary amounts to per year. In one large system the supervisor of science has been relieved

of much of his former supervisory duties and devotes the larger portion of his time to just such work as has been described.

In the opinion of the writer no lasting good is ever accomplished by an employee who has no authority. He is like a dangling football dummy used for tackling purposes, but does not accomplish as much. If supervision is to be retained in the education set-up it must be reconstructed and renamed. There has been, recently, considerable agitation for the use of the term consultant. Under such a title the present supervisor would be permitted to circulate through the schools for the purpose of determining weakness in instruction or finding places where the curriculum could be strengthened. He then would report his findings to the curriculum division who in turn might or might not call on him for expert advice. In addition to this contribution, the consultant would be "on call" to the various schools either from the principal or from the teacher to help in difficult situations. The theory involved is good but in practice it is not so good. Let us look at a few conditions which prevail in practice. Some teachers have the idea that should they call in the supervisor of a special subject, their colleagues or principal would interpret this to mean that they are a weak teacher, and hence should be marked in such a way as not to receive the next monetary increment. Further, some teachers are more than willing to receive all the assistance they can get while others do not want any help at all. Unfortunately, in most cases, those who do not wish the help are the very ones who need it and those who do wish assistance could best do without it. Such a set-up also gives the non-coöperating principal an opportunity to dispense with the use of a valuable arm of the service.

As has been mentioned before, the teacher is the heart of the educational system. No school system is stronger than its classroom teachers. So if we improve instruction at all it must be through the teacher. Most teachers, if not all, have been adequately trained in methods of presenting material to the child so that he will learn to become a useful citizen. Much has been done in this area recently. There has been a great deal said in the last decade or so relative to the view that we should teach children and not subject matter. The writer agrees to a middle of the road view on this statement. However, one of the greatest retarding agents in the teaching profession today (this is a personal opinion) is the lack of a broad understanding in the field of science by many of those who are called upon to teach children in this particular field. The best teachers are those who have great storehouses of knowledge upon which to draw when occasion demands. The National Committee on Science Teaching has set up in its philosophy report the aims and objectives to be attained by an educated person and endeavored to orientate science into the general scheme. If one does not know something about science in a very real way he will not be very useful in helping the child obtain the general objectives set up for the purpose of solving the problems of living. A teacher who is not well grounded in the subject which the child needs in obtaining certain skills and attitudes is like one in a rowboat in the middle of a lake without oars.

How the supervisor can best function under present conditions brings

forth as many answers as there are supervisors. Those who have had long experience in the field are more nearly in agreement than those with little or no experience. In fact, those who have had no experience at all are the ones who have, in their own estimation, the solution to the whole problem. They remind one of the old spinster who knows more about how to rear children than an intelligent mother who has actually done a superb job of rearing half a dozen first-class young citizens. The writer of this article has no solution to the problem of the effective and intelligent use of supervisors which will work in all cases and under all conditions. However, he wishes to offer the following suggestions for what they are worth. Under present conditions effective work can be produced by providing each head supervisor with a typist for his own use. In turn he can gather material from the literature, both current books and articles in magazines, digest the material and send regular bulletins to the teachers with brief statements as to the content of the material and where it can be found. If an item is of interest to the teacher and of particular value to her she can, without waste of time, locate and read the article or book in its entirety. The busy teacher does not have time to search through all of the current literature. In addition, the supervisor can keep a sharp lookout in the field of visual education for those slides and films which he thinks would be helpful in his field. As he goes through the schools he can gather outstanding procedures which expert teachers are using and which are actually functioning in practice. These may be written up either by the teacher or the supervisor and incorporated in the bulletins. One could go on enumerating ways in which the supervisor could function with success, but the above examples are sufficient to give the reader the idea. Such a program going to two or three thousand teachers weekly would certainly justify the existence of the position. In addition those supervisors of industrial arts, domestic science, and science should be invested with sufficient administrative authority to take care of the details of the business of attending to supplies and equipment. In addition to the above, the supervisor may still be of service in orientating new teachers and helping those who are determined to do the very best job possible, utilizing all the aids which are available to them.

The citizens of any community, or of the nation for that matter, are the stockholders in one of the biggest and most important businesses in the country, and like all stockholders, they expect dividends. It is the business of those connected with the schools to do everything possible to coöperate with each other to turn out the very best and most useful citizen possible with the raw material at hand. To educate the children of today is hard work. In education today we need less theory and more practical applications, less talk and more action. In closing, I wish to quote a sentence taken from my daughter's fraternity magazine: "A successful education can only be looked for as teachers become masters of what they teach, recognize the relation of what they teach to the society in which they teach, and have a sympathetic understanding of those whom they teach."

"Science forces are at work which in the near future will revolutionize learning." — CARPENTER.

Original and resourceful, Dr. Carpenter, Specialist in Science, of the Rochester, N. Y., Schools, has devised and tested many new aids to science teaching. Science lessons by radio and by records are but two of his latest enthusiasms. He writes of the past and of the future as he explains how

SCIENTIFIC GADGETS COME TO THE AID OF LEARNING

By HARRY A. CARPENTER

WE look in on a science room four decades ago. We see a young teacher experimenting with a friction spark machine. He had read about the new wireless discoveries and had made a contraption to demonstrate that electro-magnetic waves were transmitted by the spark to a receiving device. He cranked the machine. It sparked, and across the laboratory a bell began to ring. A gentle tap on the glass tube containing a mixture of metal filings and the bell stopped. Another spark. Again the bell rang.

The young teacher wrote to another teacher two generations older and decribed his experiment. The grandfather replied that "he would hang a telephone on the grapevine so that the young teacher could talk to him." Little did the grandfather or the grandson realize the prophetic vision of that remark. Little did the grandson realize that nearly forty years later he would be dispensing science lessons to thousands of children seated in hundreds of classrooms throughout western New York State, or describing a science meeting in Tokyo for listeners in his home town in America.

Then again, how long ago it was, and yet how short a time it seems, that the boy not yet a teacher had paid ten cents to hook a couple of rubber tubes in his ears and hear a song reproduced by the old Edison talking machine. It is a far cry from this first talking machine to modern recorded sound by means of which the teacher had a part in instructing about fourteen thousand youths scattered over many states of the Union.

Another gadget that has come to the aid of the teacher is the magic lantern. The first magic lantern projected a small picture on the wall dimly illuminated by coal oil lamps used in schools and in the home. This was followed by a most important discovery — the use of a stick of lime heated white hot by an oxygen-hydrogen flame. The young teacher used these devices and lives to see the "limelight" replaced by the electric arc, which probably still holds first place as an illuminant if intensity of light only is the criterion. The modern electric light with its concentrated filament makes the magic lantern a gadget the importance of which cannot be overestimated in the learning process. It multiplies the illustrations of the textbook a thousandfold.

How many have wished to record the colors of the sunset or the rose? How many two generations ago thought it would ever be possible? Here again science has come to the

aid of the teacher, and through color slides and color motion pictures realism is brought to the aid of the learner. Not only does this device appeal to the eye-minded, it includes sound for the ear-minded. The sound motion picture, the radio, and recorded sound aid the learning process because they do appeal to more than one sense at a time. Will the time come when the pupil will get the fragrance of the red rose as he watches and hears the humming of the bee in its search for nectar? Who can tell.

During these four decades science teachers everywhere have used gadgets developed by science to illustrate the principles they are attempting to teach. Such practical things as the sewing machine, the differential hoist, the telephone and telegraph all have played their part as objects of experimentation by pupils in order that they might enrich their understanding of the important science principles involved in their operation.

It is not the purpose of this article to describe how these gadgets have been developed, but rather to illustrate how a gadget may become an aid to teaching as well as an object of investigation. There are new gadgets appearing all of the time. One of them is an instrument for television, which even now has its value for and application to the teaching of science. Three dimensional color projection of still pictures will soon graduate into the three dimensional color motion picture class.

In education as in science many years are frequently required before an idea may be placed into action. And so we are not surprised that it took forty years for wireless to develop to the point whereby literally millions of people are becoming educated through its medium.

Radio today is accepted by the new teacher as an aid to teaching with as little concern as the teacher of two generations ago accepted the rising sun or the song of a robin. On the other hand, objectives in teaching have changed almost as radically as the gadget. The objectives have changed from the consideration of abstract principles in science to their application in everyday affairs, have changed from the demand for discipline to the demand for usefulness. And it is here that the radio, recorded sound, motion pictures with or without sound, and television have their greatest influence upon the pupil in the classroom.

Pupils and teachers are just naturally carried out of their textbooks into the world of real things. Their problems become problems of the world outside of the classroom, or the classroom problems are shown to have a real life relationship. Instead of the teacher proposing a problem and propounding the solution, the teacher and pupil working together attack the problem with all manner of scientific safeguards. It is this coöperation of teacher and pupil in trying to solve problems of the home, community, state, and nation, that is important. The gadget provides much of the incentive, background, and data needed for the solution.

It should be pointed out that the gadget, whether it is the radio receiver, recorded sound, or sound and silent pictures, does not and cannot take the place of the teacher. Nor does it lessen the need for schools with books, maps, blackboards, and apparatus of all kinds.

To the worth of the teacher, and of

these aids, the gadget adds the help of parents, brothers, and sisters as home teachers. It adds home properties for experimental work, and it utilizes the great outdoors teeming with wild and cultivated life as aids to learning. Whether it is the roar of the lion in far-off African wilds, or the voice of a king or the president of the United States which the gadget brings to the classroom, it means reality to the pupils. Pupils in the north woods of Canada or remote places in the United States may receive inspiration from the master teacher, the statesman, the minister, the physician, the mechanic, the musician, the actor and the artist, with equal value as the pupil sitting in the most favored modern classroom in the nation.

There are many kinds of broadcasts and recorded programs, each making its special contribution. There is the dramatic presentation participated in by the most skilled students and actors. It is impossible to evaluate the importance of bringing such finished programs to every child within hearing range of a radio. Sometimes these programs are recorded and schools may secure a copy of the record and use it in rooms not equipped for radio. The record also makes possible a repeated use if desirable. Without the gadget, only the favored few could reap such benefits.

A second type of program is one that brings to the classroom the experiences of leaders in practically every field of learning. Great musicians, great artists, great scientists, great adventurers, each contribute not only of their experience, but their personalities. Such programs as these stimulate the listener to wonder, to think, and to plan his future. Many of these programs, too, are recorded and available to schools.

Another type of program is more closely related to the everyday teaching program of the school. It involves a master teacher. It is he who must carry the students with him in developmental and productive experiences. It is he who must direct the activities of the pupils into purposeful learning situations. The other programs inspire, entertain, stimulate. The master teacher must do all of these and in addition he must feel responsible for direct training in the principles of science and ways of thinking. He must provide opportunities for the listener to practice scientific methods and ways of thinking as the pupil carries on suggested experiments and the solution of problems. It is the master teacher who must tie together the varied experiences of the child through their investigations of interdependent problems.

In this directed learning type of program the class situation must be maintained. The teacher is often a learner with the children, and as such becomes a better teacher. The teacher relieved of the need for being a specialist in any particular field of learning becomes a specialist in child education. The master teacher with a background of scientific training, years of experience, and libraries at his command, serves as the specialist in the case. The teacher is the most important link in this program for directing the learning of the child.

It should be mentioned also that radio or recorded programs of this type serve as effective means of in-service teacher training. A further value of the directed learning program is that the parents may be better in-

formed about the work of the schools, and indeed often become active members of the class. It is in this way that they become assistant home teachers.

The acceptance of the radio or recorded sound or motion pictures with sound as an aid to teaching implies certain demands. First, the pupil should be put into a listening frame of mind. He should have a problem to solve. This may be done through animated discussion of previous broadcast lessons, and through the discussion of problems submitted in advance by the broadcaster or recorder. Then comes the listening period during which time pupils take such notes as are needed to the solution of their problem, being cautioned not to lose important statements in the interest of note-writing.

Following the reception the classroom teacher, and occasionally a pupil leader, should carry out the suggestions of the master teacher for various activities. Principles developed should be further discussed and illustrated experimentally if practicable. Plans should be made by the teachers and the pupils to carry on their science investigations outside of the classroom, in the home, in the field.

The successful broadcast or recorded science lesson, reinforced perhaps by motion pictures, will result in several projects being carried on by different members of the class, some as individuals, others as group projects.

At no time will there be the routine textbook type of learning procedure, although the textbook will have its important use in the whole project. The text is the printed guide to the pupil's thinking and activity. It is a source book that provides not only descriptions and explanations of natural phenomena and involved principles of science, it also provides pictures which help to extend the pupil's experience. It provides diagrams, charts, and many special problems. The text becomes one of the tools of learning rather than the objective of learning.

Having pointed the changing finger of time to some ways in which scientific gadgets have come to the aid of learning, it will be unnecessary to describe the many investigations of the use of the motion picture, the radio, and recorded sound. All of these plans have been described in previous articles. The reader is directed to such sources as "New Horizons in Radio," published in the Annals of the American Academy of Political and Social Science for January, 1941; to reports published in various educational journals; to the series of volumes "Education on the Air," reporting the result of twelve annual conferences at the Institute for Education by Radio, Ohio State University, directed by Professor W. W. Charters; to the important writings and reports published by Dr. I. Keith Tyler and his associates; to the writings of many other leaders in the field of education by radio.

Particular reference should be made to the reports of the Evaluation of School Broadcasts project, a five-year study sponsored by the Federal Radio Education Committee of the Federal Communications Commission, and directed by Dr. I. Keith Tyler of the Ohio State University.

Much experimentation in the fields of radio and visual education has been carried on in various cities, state universities, and state education depart-

ments, as well as by the Office of Education.

Another source of information as to the use of radio and visual aids may be found in published and unpublished doctors' theses. In this connection should be mentioned the practical results of the many workshops conducted by colleges and universities.

The Committee on Scientific Aids to Learning, directed by Dr. Irvin Stewart, acting for the National Research Council, has carried on investigations and contributed reports on the practicability of recorded sound as a teaching aid in science, art, and conservation. This committee also has made important studies into the type and kinds of equipment and installations for utilizing radio and recorded sound. Finally, credit must be given to the great broadcasting associations and to local stations for promoting education on the air.

Television while in its infancy has become a practical gadget that may find extraordinary value as an aid to learning. While mechanical and economical reasons restrict the use of television for the present, educational committees such as that of the Department of Secondary Teachers of the N. E. A. are at work evolving plans to use this new gadget as soon as it becomes available for schools generally. One does not need to have much imagination to sense the vital importance of television to education.

The facsimile broadcasting also is finding its place in education in schools, and it is destined to play a major rôle not only in the education of the child, but the education of the adult.

Science forces are at work which in the near future will revolutionize learning. Modern methods of learning will be extended to every child, to every man, and to every woman throughout the continent, and throughout the world. What importance will this have in international understanding, and in eliminating misunderstandings which result in war? Scientific gadgets will use energy for the development of the mind as other scientific gadgets have used energy to do work for mankind. The leisure time provided by the application of energy to labor-saving devices will be made more profitable as a result of these scientific gadgets. The world will become a better place in which to live.

"The child in the grades is more interested in and able to learn about himself and his surroundings than about government, history, and social institutions." — HUDSPETH.

The dynamic young President of the Department of Science Instruction, National Education Association, Mr. Hudspeth of Austin, Texas, has already written much helpful science material for the elementary levels. As a champion of young children he challenges:

Don't Forget Science in the Grades

By JACK HUDSPETH

"A SCIENTIST is a wizened old gent who wears thick glasses, a goatee, and a frown, who calls common things by long, queer names, and who behaves a little strangely. When he works at his science, he watches tiny bugs through a microscope or he pours together vile liquids which change color and give off odorous vapors. It is all very weird, even a little terrifying; but it is vastly important to mankind, although it is beyond the comprehension of normal persons."

This is what science means to many school administrators. Of course it is important, they say, but should that sort of thing be taught to little children? Could children understand any of it? The school program is full enough as it is.

It may be unfortunate that a simplified, rational examination of the animals, plants, and inert objects and the changes taking place in the child's environment should have acquired this name *science* which has such unjuvenile connotations. This elementary school study of things and changes is homely, immediately useful to the pupil, interesting, and about commonplace things. One would think that every school administrator would welcome such a subject into his curriculum. When asked of the position of science in the curriculum, most of them think of the biology, chemistry, and physics in the high school. But science is, or should be, one of the most important subjects in the elementary school.

Let us set an example for these short-sighted schoolmen by analyzing the school program in terms of what the child should get out of it. Then the important rôle of science in the elementary grades becomes apparent.

The elementary curriculum is composed of three types of studies —(1) those that train pupils in the necessary skills, (2) those that introduce children to the various avenues of recreation and enjoyment, and (3) those that give children specific information and broad ideas that they need in their everyday living. No one of these groups is more important than the others.

The subjects in the first group—the skill subjects — include reading (for both information and pleasure), arithmetic, handwriting, spelling, and the correct use of language. Typewriting on a portable machine should also be included, but alas the cost of the machines usually prevents it.

The subjects in the second group—the recreational subjects—include physical education (in most schools a misnomer for sports or active play), music (mostly singing in the lower grades), dramatics, art, clubs, and woodwork and metalwork. (These manual arts subjects should not be considered skill subjects because their skills are not essential to successful living; they are learned by children for the pleasure that will ensue.)

The subjects in the third group—the information and idea subjects—usually include only social studies and science. The social studies includes history, geography, and the social institutions that have been devised or have developed so that people can live together successfully. Science includes practically all of the rest of the knowledge and the attitudes that the child should acquire in the grade school. Science includes all of the child's study of his environment—the plants, the animals, and the inert materials, natural and manufactured, with which he comes in contact, personally or vicariously. This is an enormous body of subject matter in science which is of far more immediate personal value to the child (especially the young child) than the contents of the social studies.

In science the pupil also studies one other important object—himself. The most important thing in the child's world is himself, and he is anxious and capable of studying the human body and its care in a detached, rational manner. Because of this study of the human body and its uses, science is a subject that can guide the development of desirable habits as well as impart useful information, general ideas, and attitudes.

In some schools there is a third information subject—health. It is supposed to be a study that promotes the formation of habits consistent with the maintenance of good health. However, this health instruction is usually assigned to the physical education teacher, which means that it is practically smothered by sports and play. Certainly there is nothing wrong with instruction in active play, indoors and out, but why it should be associated with health instruction—the formation of habits that are conducive to healthful living—is not clear. Pupils go to "gym" class to play, not to learn. The enjoyment of participation in sports has no relation to his habits of personal conduct that affect his health and well being. Therefore, in most schools any *real* health instruction that is done must be done by the science teacher.

Thus we see the extremely important position of science in the public school curriculum, especially in the lower grades where the child's mind is just beginning to grow and where his attitudes and habits are just beginning to form. Science and the social studies are the two main content subjects in the entire curriculum, and in the lower grades science is the more important because the child is more interested in and able to learn about himself and his surroundings than about government, history, and social institutions. One portion of the social studies—local physical geography—has been so neglected by the social studies teachers that in many schools the subject has had to be included in the program of science instruction.

We must remember that it is not possible for the skill subjects to be taught entirely without the use of con-

tent—facts, ideas, and generalizations. This applies to language and handwriting just as truly as it applies to woodwork, where it is obvious that the skills cannot be taught without the use of some wood. The content used in the teaching of most of the skill subjects, especially reading, is selected from both of the content subjects—social studies and science. But we must not permit school administrators to think that science is being taught in their schools just because science readers are being used in the teaching of reading. Using one or more science readers in teaching children how to read is admirable, but it does *not* take the place of teaching children facts and generalizations about their surroundings. This is just as true as its converse: children should not be expected to learn to read in a science class just because one or more books are used in the science instruction. The average child is not capable of mastering difficult skills or acquiring many facts, generalizations, and attitudes incidentally as he does something else. When a child is put to work, his objective must be immediate and limited in scope; that is why schooling was subdivided into subjects many generations ago. The nature of the child's mind has not changed much since then. We welcome the advent of attractive, interesting science readers, but as persons concerned with education in terms of what it does to children, we deplore the idea that the use of these science readers can take the place of science instruction. A cursory examination will reveal that any science textbook contains many, many times as much subject matter as any science reader written for the same grade level. This is as it should be, but, in addition, it is a fact that must be recognized by curriculum constructors.

When a school administrator thinks of his school's curriculum, he should think not only of the child's needs, as we have been doing, but he should also think of the nature of the world in which the child will soon have to support himself.

Thanks to Herr Hitler, it appears that the child of today will, if we succeed in licking Hitler, earn his living and enjoy life in an America that is vastly more advanced than at present in science and the widespread use of the methods and materials of science —factories, machines of production, materials, processes for use in everyday living, common agencies of transportation, and manufactured consumer goods. With the enormous inventive and productive capacity that this nation will have by that time, the methods and the products of science will be far more dominant in the lives of all persons than they are today. The living of the common man in America today is very unscientifically old-fashioned in comparison with the living that maybe common in America in the highly technical era that will apparently be here soon, when our new methods, new products, and enormous capacity for production are applied to the well-being of Americans rather than the ill-being of Germans and Japanese.

This American civilization of tomorrow, in which the children of today will have to compete for existence, will require of each individual far more knowledge of science than is required for successful living today. Farmers, factory laborers, repairmen, and even gardeners and janitors will not be able to compete successfully for

their livelihood if their study of their surroundings is left to the traditional high school sciences. In the world of tomorrow (in America's new order) a high school graduate *a la* 1941 will be destined to a life on WPA or a supplementary education in a practical school operated by the Federal government (similar to the present NYA and CCC schools). We must remember that by the time a child reaches the high school sciences, his basic ideas, his pattern of thinking, and his attitudes toward most things are rather fixed; his mind is not the fertile, virgin ground that was available to the elementary school teacher. All his life he will have to get along without the knowledge he missed when he was deprived of science instruction in the elementary grades. He will be a handicapped adult in his struggle for a livelihood.

I have not presented these points solely in order to inspire elementary teachers to a better performance of their duties toward their pupils and society by including science subject matter in their teaching. The omission of science in the average elementary school today is not primarily the fault of the elementary school teachers, nor are they in a position to do much about this sad situation. The fault lies with the school administrators of America — superintendents, curriculum workers, and principals. They are the custodians of the program of instruction. We see from their programs of instruction that their conception of the scope and purpose of science is incorrect. Therefore we science teachers, science educators, and better-informed school administrators must help the children of America by being missionaries. We must enlighten the school administrators of America who have apparently been keeping their heads so buried in the routine of their work that they have lost the perspective that they should have if they are to control the educational program that the children of America are to be subjected.

The National Committee on Science Teaching has essayed a job of preparing materials for teachers to use in their teaching of science, and in enlightening the school administrators who have not realized the true rôle of science in the elementary grades. But the work that this committee has done is just a beginning; it will be of little value unless science teachers acquaint themselves with it, adapt it to their own situations, and then make extensive use of it.

"More time is required to train a scientist than a pilot or a soldier." — WEBB.

Introducing himself as a fellow-craftsman whose shop is at George Peabody College for Teachers, Nashville, Tenn., the Editor of this special issue senses

IMPENDING CHANGES in the SCIENCE CURRICULUM

By HANOR A. WEBB

THE science curriculum is a national matter. Although local adjustments are to be made in topics and treatment, yet the problems of science teaching — like Federal taxes, radio programs, and football schedules—are "coast-to-coast."

If science were taught for culture only, the curriculum might be adjusted but once in a century. If science were presented for information only, the curriculum would need revision but once in a generation. But if science be offered for the needs of workers and consumers, then the curriculum must be continuously adapted and kept up-to-date.

In the present emergency for national defense the discovery has been made that far more time is required to train a scientist than a pilot or a soldier. Adaptations of science courses for immediate use are only makeshifts. The revision of a science curriculum is a long-distance matter. Curriculum planners must look far ahead.

Curriculum changes of some years ago are now having their effect. In the early '20's Physical Geography (which included both earth and weather science) practically disappeared from the high school curriculum. Today trained meteorologists are so scarce — and so needed — that frantic organization of short courses is undertaken by certain great universities by methods almost beneath their dignity. The subject of physics has disappeared from thousands of high schools just a few years before the need for training in physics becomes imperative for attractive, expanding fields such as aviation, machine design, engineering.

Tastes and talents are discovered in high schools, and when certain sciences are taught no longer in high school classrooms, the enrollment in these sciences in college will be affected. Physics, physiography, and meteorology are fundamental subjects of instruction for a busy modern nation, and the curriculum revisers who have brought about their decline were doing far more damage than they knew. Conscientious students of the curriculum are saying, "If we could only look ahead!" Curriculum experts *must* be chosen from those educators who *do* possess foresight, for the science curriculum in particular is for the future, not the past.

Uncle Sam's offers of employment to young college graduates who have majored in the sciences turns a spotlight upon the problem. Through the Civil Service Commission, appointments as Junior Professional Assistants are open at $2,000 a year—not an unworthy sum for a science major without experience. Even the undergraduate may enter the Nation's service as a Student Aid, working in the

summers (under certain conditions) at $1,440 a year.

Definite quantities of college credits are required of Junior Professional Assistants; 30 semester hours is a typical amount. These qualifications met, an examination must be selected from some twenty "options"; each is a major field. In 1939 the number taking the examinations was 38,976; the number passing, 9,431. In 1940 there were 44,160 takers, 11,268 passed; in 1941, 38,292 takers, 7,700 passed.

The large proportion of failures in these examinations must have some significance. The ratio of passing to the total number examined is 1 to 4.1 in 1939, 1 to 3.9 in 1940, 1 to 4.8 in 1941, 1 to 4.3 for all three years. The quality of instruction may be blamed, the waning intellectual powers of youth be offered as a theory, other unprovable suggestions presented. But comments of U. S. Civil Service Examiners[1] point rather strongly to the curriculum itself. One of these gives the illustration of a college major in Economics who selects music or literature as a minor, rather than the minors in statistics and accounting which are absolutely necessary for service with the Government as Junior Professional Assistant in Economics.

All science teachers are familiar with the curriculum looseness that permits such extensive election and unrelated courses so that science majors, upon graduation, cannot by any stretch of the truth be called "junior scientists." That approximately three out of four such majors fail in the practical examinations of the Civil Service Commission is objective evidence of their unpreparedness, whatever the cause may be.

What kinds of young scientific workers are in greatest demand by Uncle Sam? There follows a list of the "most active registers"—a phrase of the Commission meaning the fields in which appointments are most numerous. In parenthesis is the number of eligibles produced by the 1941 examinations. In subsequent paragraphs the "moderately active registers" and the "least active registers" follow, with numbers of eligibles. As these are read, observe a distinct negative correlation between need and supply; broadly, there are *more* eligibles in many of the fields where there is *less* opportunity!

At the head of the list comes the registers of Junior Engineers, Junior Meteorologists, Junior Physicists. So great has been the demand for these that the examinations have been made continuous, and those who pass receive prompt appointments. Many types of physicists are wholly unavailable, particularly in the specialized fields of sound, radio, electronics. Yet in the curriculum changes during the past several years the slumps have been in advanced mathematics, meteorology, and physics. No trend could have been more unfortunate for the present activity of young scientists.

Other very active registers for appointments as Junior Professional Assistants are these: Administrative Technician (579), Agronomist (154), Soil Scientist (167), Range Conservationist (133), Forester (314), Business Analyst (744), Economist (992).

Moderately active registers are these: Legal Assistant (860), Chemist

1 The courtesy of Lawson A. Moyer, Chief Examiner for the U. S. Civil Service Commission, and William C. Hull, Executive Assistant, is acknowledged for the specific data here published, and the informal judgment expressed above.

(822), Geologist (414), Writer and Editor (1,290).

The least active registers are these: Animal Nutrition (30), Biologist (224), Home Economist (257), Horticulturist (30), Zoologist, Parisitology (25).

The Federal Government is not the only employer of college-trained scientists of small experience. Many positions similar to those listed in the examinations for Junior Professional Assistant undoubtedly exist in the service of the States, although the requirements of training, and the type of examination necessary to prove qualifications, will vary widely. There is private employment, too, in every option of the examinations. The conditions of these opportunities throughout the nation would make a difficult but valuable study.

So the colleges and universities may teach science, yet not train scientists! Many of us are familiar with the discussions of several years ago that resulted in broader curricula. There has always been debate concerning general versus specialized study—the shotgun versus the rifle method in education. Within recent years the broader way has gained favor; it has seemed wiser to teachers, and was undoubtedly easier for students. Our nation is reaping the harvest of the changed curricula in science in the form of a scarcity of trained scientists in time of emergency. "If we could only have looked ahead!"

It must be admitted that emergencies may be unforseeable, and in times of pressure individuals, and nations, must do the best they can with what they have. But emergencies do not last forever. The larger needs of a nation are according to the changes that come slowly and surely, instead of suddenly. Many of these changes can be detected in the life of a nation as they begin. Certain of these beginnings have been made so scientifically and usefully that their permanency can hardly be doubted. These — and changes like them—should be the basis of curriculum study for the future.

I. *More outdoor scientists will be needed in the future.* Most of these will be working in the broad field of Conservation. Soil conservation may require the services of more young engineers for contours and dams than did the railroads and the highways in the days of their construction. Scouting for new minerals and oil deposits will be the work of practical young geologists using complex laboratory equipment, rather than the luck of grizzled old prospectors. Range conservation, to be practiced wherever grass should grow, will be supervised by experts who know plants and animals rather than guns and lariats. The "balance of nature" so familiar to biologists as a principle will become a practice in all regions of the nation, where experts in wildlife will protect the useful finny, furry, and feathered creatures with the full backing of enlightened laws of the Government, consistent at last with the laws of nature. The wasteful exploitation of our nation's natural wealth seems drawing to a close, and the effective programs of conservation will require many trained workers indeed.

II. *More scientists will work in the fields of health.* Added to the direct services of physicians will be the work of experts in sanitation, foods, water and sewage, and many other as-

pects of community hygiene. It is obvious that the nation needs them desperately. Figures concerning the selectees for army service show a surprisingly poor health level for a civilized, scientific country. An army of trained public health workers would truly be an "army of defense."

III. *More scientists will be busy in the field of public relations.* This is a scientific nation, but the adjective has not been consistent with a sixth-grade educational average. The future generations will be chiefly high school graduates, able to understand, — and preferring to receive—simple technical information concerning the products that interest them. There is already a notable trend in modern advertisements to picture and explain the newer principles of modern inventions fluorescent lamps, stainless steel, diesel-electric locomotives, the simple technology of aluminum, glass, plastics, automobile machinery. Fewer fakes and more facts will be presented to the future public; training in science rather than in superlatives may be essential to future advertisement writers, and publicity men.

IV. *There will be more scientific teaching of science.* Just as the telephone company trains experts to analyze the areas around a city, and make plans for cables and exchanges while the regions are still pastures and fields, so are experts needed who know the principles of science, the practices of industry, the psychology of people, the laws of learning.

To such experts we would be willing *now* to commit the science curriculum. Such experts exist, but the politicians —members of state, county, city, or even school organizations—do not consult them often or give them freedom to test their plans. Science teachers are anxious to look ahead, not as does a fortune-teller with a crystal ball, but as does a farmer who sows seed, or a forester who plants seedling trees. There is responsibility for the future laid upon all in science education, from the most astute engineers of curriculums to the most humble classroom teachers.

THE SPEECH-CENTERED SCHOOL

By EDSON C. BATES

TOWARD the end of the busy spring semester, Mrs. Georgia H. Gilbert, at my request, granted me some time in which she explained in detail the work of speech correction in the Mt. Vernon schools. It was not long before she recollected with a rare enthusiasm a former case which had taxed her ability to the full.

"My great satisfaction came on a Christmas afternoon," she began. "I was enjoying my holiday at home when the telephone rang. No sooner had I answered it than an abrupt burst of joy came forth:

" 'I'm sorry to bother you on Christmas. But I just had to let you know how happy I am. This is the first time in eight years that Mary —— has talked with her friends at the table. Her nine months of speech instruction with you were priceless. All I can do is thank you from the bottom of my heart! ——.' "

"Mary's was a case of delayed speech which needed immediate attention," Mrs. Gilbert explained. "Through my persistent efforts, the child learned the correct placement of vowels and lip consonants, and her speech muscles were coördinated. By constant observation and imitation, Mary at last acquired a sizeable vocabulary in her first primer, and became much interested in her school work, as well as in mingling with her fellow pupils."

This is only one of thousands of individual cases which have come under the care of Mrs. Georgia H. Gilbert, who has had sole supervision of remedial speech work in all the public schools of Mt. Vernon for the past seventeen years.

The old proverb, "Train a child in the way he should go, and when he is old he will not depart from it," was perhaps never so aptly applied as it is in the case of speech habits. In a yearly report published in 1929, Mrs. Gilbert explained that after the fourth year of her work, cases of lisp and phonetic defects were growing less each year. She wrote, emphasizing the work with young children: "We are strengthening the organs of speech by exercise in all the lower grades, watching the children very carefully for the first symptoms. We realize that in proportion to the length of their persistence is the depth of the impression, and that by getting at the difficulty we eliminate re-education."

Mrs. Gilbert, however, has not confined herself to the correction of pupils of school age. Cases of pre-kindergarten children have come under her supervision, as well. In parent-teacher meetings, mothers have heard her lecture on speech correction, and have requested help in giving home instruction. Mrs. Gilbert has warned that home conditions may aggravate the speech difficulties of pre-school children. Speech correction, like charity, begins at home.

The mention of pre-school children brought to mind a case of cleft palate in a three-year-old girl, which Mrs. Gilbert had treated privately. Six delicate operations by a noted surgeon had succeeded almost completely in effacing the deformity. What was next needed was a thorough education in all speech sounds, to compensate for the delayed training.

"I could not hold the child's attention for over a minute at a time," Mrs. Gilbert recalled. "After a year, however, we could carry on ten-minute conversations effectively. At six, just before the girl started school, we had increased the practice periods to three quarters of an hour. That girl," Mrs. Gilbert added with emphasis, "is now in junior high school. She has made up for her early deficiency, and speaks better than her classmates."

Amazed at the thoroughness of the correction program, I was curious about the attitudes of young children in overcoming lisp, nasality, and other more serious defects.

"Do your pupils resent the time spent with you, preferring to be in regular classes with their 'normal' classmates?" I asked.

"No," was the reply. "On the contrary, they welcome the periods they spend with me. My first objective is to win their confidence. I encourage them to tell me their special problems. Stammerers and stutterers, especially, need to be won over in this way, since they show, more markedly than other cases, evidences of lack of self-confidence. Maladjustments in class work usually accompany these cases. For this reason, I try to show my pupils that their practice is a basic aid to their regular class activities. No pupil of mine looks upon his speech work as an escape from class work; neither does he feel that it is an ostracism from his fellow pupils."

"You spoke about stammerers with special problems," I continued. "Do these pupils appear worried over their speech?"

"All of them do. Speech difficulties, of course, affect attitudes in other spheres, and make personality adjustments all the harder. Stammerers need more individual attention than other cases. A girl in one of my schools was thought by her principal to be abnormally stubborn and haughty. When I had occasion to meet her, I discovered how seriously she had been misjudged. She had a particularly severe stammer which prevented her from uttering anything at all, when spoken to. In my weekly periods with her, she was reticent for a long time; but later, she grew to trust me. In fact, at one time, I was the only person in the school who really had her confidence. Then gradually, she blossomed out, and her whole demeanor changed. She has become more friendly toward her teacher and her classmates, and is now undertaking the correction of her stammer."

"This case must have been gratifying to watch, I am sure," I said. "At what age does a child usually coöperate actively in setting new speech habits?"

"That depends upon the intelligence of the child," Mrs. Gilbert answered. "If you start with a child in the early grades, it is possible to set new habits which he will adopt readily; then, through encouragements and chal-

lenges, you can instil in him a will to conquer his difficulty."

"Is the idea of steady advancement easy to foster in young children?" I asked.

"All instruction must, of course, be adapted to the age of the child. In our schools, we have a code which we call 'Our Aim'; these are its points:

1. To give confidence to the child.
2. To bring out the voice of the child.
3. To establish correct habits of speech."
4. To strengthen the muscles of speech.

"With young pupils, one must first introduce games. In kindergarten, for instance, we play a game of telephone. The youngsters repeat in vibrant tones numbers like *nine*, *one*, *seven*, *ten*, fine exercises in placing the tip of the tongue and holding sounds. Then, they make up short sentences to speak into the mouthpiece. For lip practice on sounds like *m*, *b*, *p*, and *w*, we play an animal game. The children take the parts of animals, each speaking in characteristic utterance: the cow, 'moo,' the sheep, 'baaa,' the bird, 'peep,' and the owl, 'oo.' To emphasize the importance of the endings of words, I jokingly suggest that a 'ca' ' without the 't' would have no tail. Amused by this anomaly, they are careful to pronounce a distinct 't' at the end. One day, in the midst of one of these periods, I left the pupils alone for a short while, and to my surprise when I returned, they were continuing the games, correcting and coaching each other as I had taught them. How better can we instill good speech habits in young children, and carry out Our Aim?"

"You certainly place great stress upon setting new habits when children are young," I observed.

"We try to set a good speech foundation, and to strengthen the speech centers of the brain early in life. In this way, the child is better equipped to ward off the effects of any accident or shock which might later cause a stammer. Young children must be made conscious of many different aspects of speech. The visual aspect I teach by the use of mirrors, giving each child an actual picture of his own speech organs in action. Auditory training allows the child to distinguish shades of difference in vowel sounds, and to correct confusion in consonants. Physical factors such as lip and tongue flexibility, diaphragm control, deep breathing, and placing of the voice, are of vital importance. In fact, the normal speakers in our schools are notoriously careless about enunciation and pronunciation. I have found that pupils with definite handicaps to begin with, turn out to be better speakers, on the average, than so-called 'normal' speakers who have not had this essential auditory training and drill work."

"Children usually crave a definite series of steps to follow in learning a new technique," I put in. "Do you use a graded procedure in conducting drills?"

"The system I use for most cases is made up of these six steps:

1. Drill on sounds.
2. Drill on words.
3. Use of words in short sentences.

4. Reading aloud.
5. Impromptu speaking on some topic.
6. Conversation.

The easiest type of speech thus leads naturally into the most complicated, and pupils can check their progress along this scale."

I wished to know something of the nature of Mrs. Gilbert's administrative work, and how she divided her time among the many schools. She explained that she visited the sixteen schools under her jurisdiction either weekly or every two weeks, attending two schools each day. She had devised this system herself, as the one best suited to the welfare of the children.

"When I first came to Mt. Vernon in 1923," she continued, "I had one central office where cases were sent daily. This way of handling the correction was an undue inconvenience for all pupils. It meant, further, that many children of the kindergarten and early grades would necessarily be neglected, the very children who had the best chance of speedy correction! Also, it was impossible to confer with class teachers regarding the progress of individual cases during the week. The present system is more strenuous for me, but I am confident that I establish closer contact with more pupils needing this special work."

"What consideration is shown in class for those pupils with speech handicaps?" I asked.

"My pupils all recite with their regular classes as best they can. In junior and senior high schools, some pupils recite all their required oral work to me, and receive their grade mark from me. By this procedure, such pupils are not penalized in their regular class work, and normal class routine is not broken."

"Are teachers as a rule coöperative in reporting the progress of your cases during the week?" I asked.

"Without the daily follow-up work done by the class teachers, my weekly visits would be of little help. I do not expect teachers to give very much special attention to individual pupils of mine. But I must depend upon their observation and coöperation, and I feel great appreciation for this help. Each teacher is required to report cases of any speech disorder to me immediately, so that no time may be lost in beginning the correction program."

"I see that a necessary part of your work is to teach the teachers things to watch for in pupils' speech," I observed.

"You are right there," she answered, "for if teachers do not set good examples, we cannot blame pupils for a bad showing. Teachers as a whole could well afford to be more speech conscious, even in the case of so-called 'normal' speakers."

At this point, Mrs. Gilbert reached into her desk and drew out a card with this motto, printed in good clear type:

My Speech Creed

I have a pleasing voice
I bring out the meaning
I give the endings of my words distinctly

"This motto which is placed conspicuously in each classroom helps to foster speech consciousness in all pupils. Those who follow these points are excused from special drill; others are trained until they practice them

consistently. Though I most heartily urge more drill work of this sort, I can say that as a result of the work thus far, nasality and substitution of letters (a carry-over from baby talk) have practically vanished before high school."

"Could you give me some idea of the number of individual cases you treat each year," I asked.

"I have just sent in my annual report. This year, it shows 1,400 cases, which include those with lisp, stammer, stutter, foreign accent, voice and phonetic defects. You see by this how sorely I need additional trained teachers who can devote full time to correction work. But I believe that our good record thus far will be a strong argument in favor of granting our branch a larger personnel."

I thanked Mrs. Gilbert for this stimulating account of her work, and bade her good-bye, hoping that her well-earned vacation would be a pleasant one.

This wide speech program in which the welfare of no pupil is overlooked contains, I am certain, a wealth of suggestive hints both for teachers and for all those entrusted with the task of rearing sensitive children.

EDITORIAL

MARY RIDGE *as an* EXAMPLE *to* EDUCATORS

By CARL G. MILLER

EDUCATORS should take an interest in Charles F. Vatterott Jr. of Saint Louis. As a child he was the oldest in a family of eleven; as a parent, he is the father of eight. In the real estate business, he has recently developed Mary Ridge, a suburban plot of 53½ acres on which only families that believe in rearing children—not a child—may live.

Mr. Vatterott's acreage has been divided into 100 half-acre lots, with the other 3½ acres a children's playground. Eighty per cent of the finished homes are occupied, many having been sold before they were built. Just try to live there if you happen to be childless parents, and you will feel like the fathers and mothers who tried to rent certain apartments or homes and were told, "Sorry. No children or dogs." The average family now living in Mary Ridge has five or six children.

Perhaps the interest of educators in Mr. Vatterott's project is more or less indirect, but it nevertheless should be strong. Teachers and administrators are taking more and more of an interest in the background of their pupils for the purpose of understanding them, and this motive is certainly not to be condemned unless it be on the grounds of shortsightedness. Instead of being interested in what *is* the background of the pupils, shouldn't they be interested also in legislation to improve it? Teachers must accept children in the stage in which they find them and do their best to develop them from that level. But are we stopping to think once in a while that the stage at which we find children is often far too low in the scale of healthy normal development? And after reaching such a conclusion are we using the means open to us—the local P. T. A., for instance—to try to improve conditions? By the nursery school we meet a condition, but what about trying to alter that condition?

All this interrogation is simply to show that Mr. Vatterott's idea is at once so brilliant and at the same time so obvious that many of us should have thought of it before. Let's take the principle of friction, for one thing. We get friction by rubbing two things together, the result being heat. We get friction in the form of disagreeable human emotion when we have human beings too close together. The human friction being developed between parents and children and among neighboring children because they live too much in contiguity is something for mental hygienists to consider. Then there's the health angle. Compare the opportunities for the children on a 25 or 50 foot lot with those on a half acre. Finally dwell for a moment on the idea of discouraging the anomaly of the one-child family. Think of the education in character and personality that the child of a several-children family has already received when he arrives at school compared to that of the child who has only his mother and father and probably sees too much of both!

Mr. Vatterott may or may not have considered the educational advantages of Mary Ridge. But others, such as educators, can well consider the educational advantages of his plan and see if they cannot be of assistance in some legislation that will develop families on appropriate-sized spaces of which this country certainly has plenty.

BOOK REVIEWS

New World of Chemistry. By *Bernard Jaffe*, Chairman, Department of Physical Science, Bushwick High School, New York City. Silver Burdett Company, Boston. 692 pages. 1940. $1.84.

The words of dedication, printed at the beginning of this book, set forth its inspirational nature and its guidance characteristics. They are—

"Dedicated to the spirit of chemistry, to the unselfish and inquiring men and women who have given us chemistry, and to the boys and girls who through chemistry will make a better world for all."

Such a motive in writing a book should insure its success. Evidently the book was written, not so much to sell, but to inspire, teach and guide. What a joy to find the writer of a textbook wishing to "make a better world for all"!

The story style makes the reading very alluring. Frequent reference to great chemists and their work, to literary sources, and to historical events adds a charm. Many unique (often full-page) illustrations of modern chemical procedures, of ancient and recent chemical devices, and photographic reproductions of great men and women of chemical renown, make the book the more attractive. Tables, charts, formulae, references, bibliographies, questions, problems, projects and activities abound throughout the volume. A chapter on "Useful Materials for Reference" closes the book, excepting that the usual Index has the final pages. The close relationship between mathematics, physics, mineralogy and chemistry are constantly suggested. Many of the more important chemical elements and the more useful compounds are discussed at chapter length. Stories of very recent chemical accomplishments are set forth in such style that a boy or girl, reading this book, might aspire to great discovery.

Though not a chemist, the reviewer of this new book is most appreciative of its high value. Though selling for a very small sum and purchasable by even a poor person, it contains chemical riches. It has special values for a teacher of chemistry who wishes to make his subject appealing to students.—EARLE AMOS BROOKS, Boston University School of Education.

Science for the Elementary School Teacher. By *Gerald S. Craig*, Consultant in Elementary Science, Horace Mann School, and Associate Professor of Natural Sciences, Teachers College, Columbia University. Ginn and Co., New York and Boston. 551 pages. 1940. $3.00.

In this substantial book there is presented an excellent summary of the more commonly-studied sciences. In simple survey form, many of the more important facts are given, for child instruction, in the fields of astronomy, geology, meteorology, zoology, botany, and biophysics. An impressive stress is laid upon the relationships of the inorganic and organic realms and there are many points of great ecological value. Anthropological suggestions; biochemical hints; facts concerning bacteriology; and many points of interest in the fields of comparative anatomy and comparative physiology are cogently revealed.

Part One is made up of three chapters, "Science and Elementary Education," "Science and the Classroom Teacher," and "Science and the Child." These chapter-titles suggest the valuable information which is given in regard to the instructional procedures in science teaching. With such a guide as this book affords, almost any teacher with fair intelligence and some skill could make effective, in the elementary grades, a course in the important fundamentals of the Natural Sciences.

Part Two is devoted to subject matter, a number of clear-cut illustrations, adequate bibliographies, and suggested topics and questions for study and research.

The pages are large and attractive and the type used is clearly legible. A definite attractiveness pervades this new book.

It is such a volume as the reviewer delights to recommend to progressive teachers of the grades.—EARLE AMOS BROOKS, Boston University School of Education.

Amos Eaton; Scientist and Educator. *By Ethel M. McAllister.* University of Pennsylvania Press, Philadelphia. 587 pages. 1941. $5.00.

Amos Eaton (1776-1842) is one of those great schoolmen whose careers have done so much to enliven the pages of the history of education in America. He is remembered today for his great work as the founder of the Rensselaer School which later became the Rensselaer Polytechnic Institute. It was in Troy that Eaton first worked out his educational ideas in field work and laboratory practice in the teaching of the natural and applied sciences. Eaton was the father of American geology, a botanist of note, a competent zoologist, and a pioneer in chemistry. He was also a flesh-and-blood human being living at a critical time in the history of our country. (He was born forty-eight days before the birth of the United States of America.) Miss McAllister's biography of this great educator is scholarly and extremely well documented. It is also most interesting.—WILLIAM P. SEARS, JR., New York University.

Child Psychology. By *Charles E. Skinner* and *Phillip L. Harriman*, in collaboration with others. The Macmillan Company, New York. 522 pages. 1941. $3.00.

This book, addressed primarily to students in schools of education and to parents, covers all phases of child psychology. The volume is comprehensive, modern, integrated, and functional. The emphasis is on the normal child in relation to his integrated and growing personality. Since a great many experienced teachers have collaborated in preparing the chapters there are very obviously some chapters of greater worth than others. Throughout, however, the method of preparation is simple and factual. Provocative questions and exercises follow each chapter. The selected references for further reading are especially full and complete. A comprehensive outline of the entire volume forms an appendix. This feature will assist many teachers who are offering courses in child psychology or child development.—WILLIAM P. SEARS, JR., New York University.

Psychology of Personal Adjustment. By *Fred McKinney.* John Wiley and Sons, New York. 636 pages. 1941. $2.75.

In his introduction to *Psychology of Personal Adjustment* Professor McKinney states: "This book was written to meet the need for a basic psychological text which frankly attacks the problems of the student that are most vital to his personal adjustment and offers him factual material on these problems." The volume is not a text in general; rather it combines material often taught in courses in mental hygiene, personality development, how to study, vocational selection, and orientation to college and adds other material needed by students, as indicated by studies which have been made. The book, which is really a mental hygiene with especial emphasis on the college period, is admirably suited as a text for freshmen and sophomores in the liberal-arts colleges. The material presented is based upon sound scientific data and written from the student's viewpoint.—WILLIAM P. SEARS, JR., New York University.

Mental Hygiene in Education. By *Ernest W. Tiegs* and *Barney Katz.* The Ronald Press Company, New York. 418 pages. 1941. $2.75.

Today, educators have sensed the unique importance of mental hygiene in personality adjustment and are attempting to use mental hygiene principles in pupil guidance in all areas of school activities. As yet, most teachers are not as familiar as they should be with the mental health hazards of childhood and youth. *Mental Hygiene in Education* is a splendid book for all teachers and administrators to read and to study. Moreover, the book is admirably suited as a text for a course in mental hygiene and personality adjustment—a course that should be required of all prospective teachers who are preparing for their careers in the teacher-training institutions of this land. The authors have divided their volume into

three major portions — The Nature and Origin of Personality Difficulties; Improving Personal and Social Adjustment; and the More Serious Personality Difficulties. Some very fine chapters include those on Mental Health Hazards of Childhood and Youth; The Struggle for Integrity; Confusing, Misleading, and Limited Theories of Personality; Modern Psychological Theories of Personality; Aiding the Maladjusted in School; and Measuring and Interpreting Improvement in Personality Adjustment. The volume is most comprehensive and includes a wealth of material with which every teacher ought to be conversant. There are numerous tables and charts which add to the value of the volume. A summary concludes each chapter and this is followed by a number of pertinent questions and suggested exercises. Fine bibliographies, too, have been appended to each chapter. The teacher-training institutions will find in *Mental Hygiene in Education* a fine classroom text.—WILLIAM P. SEARS, JR., New York University.

Consumer Science. By *Alfred H. Hausrath, Jr.*, Director of Student Teaching, Iowa State College, Ames, Ia., and *John H. Harms*, Head of Science Dept., Ames (Iowa) High School. The Macmillan Co., N. Y. $2.40 (with discount). 692 pages. 1939.

This book is handsomely bound, attractively printed and freely illustrated. Its chief purpose seems to be to "suggest a knowledge of science as a protection to the consumer from the enticements of the advertiser whose claims are as frequently based upon a fertile fancy as upon firmly-established fact and whose purpose is often to sell a product rather than to satisfy a need." It is written in the earnest belief that all students, and not merely those who are preparing for advanced work in the Sciences, should study the scientific facts that are necessary for practical, interesting and useful living.

Many students do not take courses in Chemistry, Physics and Biology. Nevertheless they need to have the practical facts of these studies in order that they may buy wisely, use efficiently, and work conservatively. This volume furnishes useful facts and helpful information for such persons. They will do well — those young people who are not completing college or university courses—to have such a compendium of practical science.

Some books of similar purpose are rather sensational. This one seems to be sane and balanced.

For student, teacher and general reader this is a book that will serve well in a busy world and in a life that has its constant economic problems. — EARLE A. BROOKS, B. U. School of Education.

Economic Geography. By *Clarence Fielden Jones.* In Collaboration with *Gordon Gerald Darkenwald.* The Macmillan Company, New York. 1941. $4.25.

This is a most comprehensive and exhaustive text in economic geography. Throughout the book the occupational approach is followed. Here is no antiquated, encyclopaedic enumeration of facts for one region after another or for one commodity after another. Rather here is the natural grouping of related activities or industries. Thus, the student will obtain most readily a working knowledge of the production and distribution of the chief commercial products of the world. The book abounds in maps, cartograms, and graphs that present the necessary statistics in splendid fashion. The volume is well written and the great wealth of material is magnificently organized. It is a grand text for a year's course in economic geography on the college level. — WILLIAM P. SEARS, JR., New York University.

How to be an Engineer. By *Fred D. McHugh.* Robert M. McBride and Company, New York. 1941. $2.00.

Here is another volume to add to that ever-increasing list of books dealing with various aspects of vocational guidance that must be placed on the shelves of every high school library. In this book is graphically told exactly what the youth of today must know to fit himself for a career in engineering. Vocational counselors and advisers, as well as classroom teachers who do any guidance work, will welcome the volume for the forthright manner in which Mr. McHugh presents his material. After brief introductory chapters on the work of the engineer in modern society and the aptitudes and alti-

tudes essential for success in the field, Mr. McHugh discusses in turn the more important branches of engineering. An all-too-brief chapter on "What College?" is rather sketchy and advisers will find it necessary to supplement this chapter as they counsel with individuals in their local situations. A helpful list of books and magazines for prospective engineers concludes the volume. The book is written for the high school youth. Throughout, the author stresses the importance of English, both written and spoken, for the engineer. Some very fine pictures enliven an already live text.—WILLIAM P. SEARS, JR., New York University.

The Neuroses in War. By Several Authors under the Editorship of *Emanuel Miller*. With a Concluding Chapter by *H. Crichton-Miller*. The Macmillan Company, New York. 1940. $2.50.

This is a very timely volume dealing with the problem of nervous responses of people at war. It was during the first World War that psychiatrists had an opportunity to study the neurotic casualties of warfare on those who engaged in that great cataclysm. In the years that followed much of the data that were gathered were coördinated and formulated into rather definite conclusions. Here we are in a second World War and, since human nature does not change, the need for a thorough study of this material is obvious. The present volume was written in England and it will appeal to physicians, psychiatrists, army officers, and all those (including teachers) who are responsible for community morale.—WILLIAM P. SEARS, JR., New York University.

The American Novel—1789-1939. By *Carl Van Doren*. The Macmillan Company, New York. 1940. $3.00.

This is a complete and exhaustive history of the novel in the United States from the infant days of the new Republic to the present. An earlier edition of this work was hailed by scholars and general readers alike and this enlarged and completely rewritten study will undoubtedly receive even wider acclaim. Mr. Van Doren discusses hundreds of books and the movements of which they were a part; he also discusses the authors and the events which prompted their writing. All of the great novelists of our past—Cooper, Hawthorne, Mark Twain, William Dean Howells, and Henry James—are treated at length. There are also chapters on Melville, Dreiser, Willa Cather, and Sinclair Lewis. A concluding section evaluates the work of John Steinbeck and praises especially *The Grapes of Wrath*. *The American Novel* is a volume for every teacher of literature as well as for all who are really interested in the novel as a form of literary expression. Mr. Van Doren's point of view is truly catholic and his judgments are liberal and free from bias.—WILLIAM P. SEARS, JR., New York University.

Motion Pictures as an Aid in Teaching American History. By *Harry Arthur Wise*, Ph. D. Yale University Press, New Haven. 1939. 187 pages. $3.00.

This is the report of an experiment in education carried on by Dr. Harry Arthur Wise and published for the Department of Education in Yale University. The study was made to ascertain some of the contributions of motion pictures as aids to the teaching of American history at the senior high school level. Some ten thousand and more students in twenty-eight history classes were involved in the experiment.

The experimenter followed carefully and intelligently the best techniques available in the field of educational research and these are described in full detail in the report.

Among Dr. Wise's conclusions and recommendations is the following statement:

"The motion picture is an instructional tool of tremendous power in the accumulation of knowledge and ideas and in the development of attitudes and appreciations. Because of its peculiar nature, that is, the unique quality of motion which it possesses, it contributes something to learning which is otherwise unobtainable. However, as a tool for history teaching it is not a method or end in itself but a supplementary aid. The motion picture can never be more than a supplementary aid until the framework which links a series of historical incidents together no longer needs to come from books."—WILLIAM P. SEARS, JR., New York University.

Methods for New Schools. By *A. Gordon Melvin.* John Day. 1941. 301 pp.

There are five parts to the book. Part I gives a whole view of methods, emphasizing the child, his personality, and his experiences as the fundamentals in all good teaching. The vision developed in these chapters is inspiring, and compares favorably with the similar visions of Parker, McMurry, or Dewey.

The vision is not fully realized in Parts II to V, which take up in order the teaching of (1) the tool subjects, under the heading "technical experiences" (numbers, language, reading, writing, spelling, tools and machines), (2) artistic experiences (music, art, creative writing, drama, dancing), (3) scientific experiences (science, earth, plants, animals), (4) social experiences (community civics, history, probably geography). Subjects as such are condemned, but subjects cannot be avoided and so are discussed.

The general view presented is much above the average, but generally below the practices in the best schools. The task undertaken is too large for one person. Specialists in the various fields could have done better,—Gray in reading, Horn in spelling, Freeman or West in handwriting, etc. In discussing some subjects few references are used and those not always the best. The spelling load recommended is too large, the most fundamental viewpoints in teaching spelling are omitted, much of the traditional is commended for arithmetic, the view on elementary science is meager, the social science program is inadequate.

Yet the general view in all subjects and all teaching is excellent; the criticisms of current practices are stimulating. For the teacher, principal, or administrator who doesn't know what has been happening in elementary education during the past quarter of a century, the book should prove very helpful. It is a good start, a start in the right direction. For detailed help in particular fields or subjects much more is needed.—GUY M. WILSON, Boston University School of Education.

Useful Books for the Teaching of Science

INTRODUCTORY ORGANIC CHEMISTRY
By E. WERTHEIM, Ph.D., *Univ. of Arkansas*
Illus, Glossary. $3.00 (Ready Jan. 1942)

COLLEGE PHYSICS—3rd Edition
By ARTHUR L. FOLEY, Ph.D., *Indiana Univ.*
470 Illus. 757 Pages. $3.75 (1941)

ELEMENTS OF GENETICS
By EDWARD C. COLIN, Ph.D.,
Chicago Teachers College
47 Illus. 386 Pages. $3.00 (1941)

HYGIENE—3rd Edition
By F. L. MEREDITH, M.D., *Tufts College*
183 Illus. 822 Pages. $3.50 (1941)

PLANTS AND MAN
By C. J. HYLANDER, Ph.D., *and*
O. B. STANLEY, Ph.D., *Colgate Univ.*
308 Illus. Glossary. 518 Pages. $3.00 (1941)

LABORATORY GUIDE IN ELEMENTARY BACTERIOLOGY
By M. S. MARSHALL, Ph.D., *Univ of California*
244 Pages, $1.75 (1941)

THE STORY OF VARIABLE STARS
By LEON CAMPBELL *and* LUIGI JACCHIA,
Harvard College Observatory Staff
82 Illus. 226 Pages. $2.50 (1941)

EARTH, MOON AND PLANETS
By FRED L. WHIPPLE,
Harvard College Observatory Staff
140 Illus. 293 Pages. $2.50 (1941)

THE MILKY WAY
By BART J. BOK, *and* PRISCILLA F. BOK,
Harvard College Observatory Staff
96 Illus. 204 Pages. $2.50 (1941)

BETWEEN THE PLANETS
By FLETCHER G. WATSON,
Harvard College Observatory Staff
106 Illus. 222 Pages. $2.50 (1941)

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